(USAF) T.O. 31R2-2GRT3-13
FORMERLY AN16-35T282-3
(NAVY) AN16-35T282-3

HANDBOOK
OVERHAUL INSTRUCTIONS

RADIO TRANSMITTER T-282/GR AND T-282B/GR AND MODULATOR-POWER SUPPLY MD-141/GR AND MD-141A/GR

(RADIO RECEPTOR CO., INC.)

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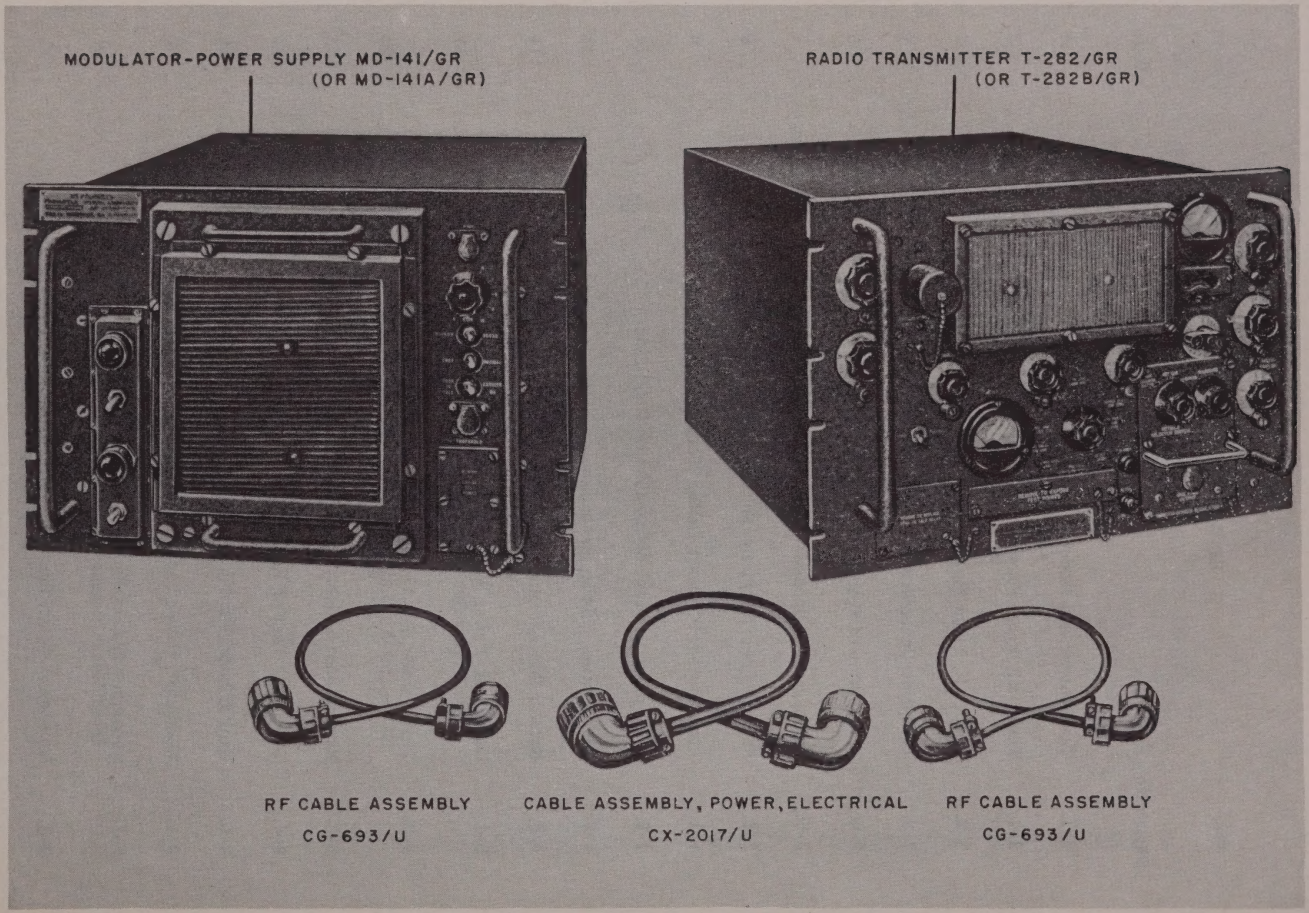


Figure 1-1. Transmitter and Modulator-Power Supply

SECTION I

DESCRIPTION AND LEADING PARTICULARS

1-1. GENERAL.

1-2. This publication contains overhaul instructions for Radio Transmitter T-282/GR (or T-282B/GR) and Modulator-Power Supply MD-141/GR (or MD-141A/GR), major components of Radio Transmitting Set AN/GRT-3. In addition to the information contained in this handbook, more data is available in the applicable Handbook of Operating Instructions, Service Handbook, and Parts Catalog for this equipment.

1-3. Radio Transmitter T-282/GR (or T-282B/GR) is a single channel UHF (ultra high frequency) transmitter which covers the frequency range from 225 mc (megacycles) to 399.9 mc and is capable of supplying 100 watts r-f power into a 50-ohm antenna. The transmitter circuitry consists of a crystal controlled oscillator, frequency multipliers, buffer amplifier, power amplifier, and monitoring facilities. An antenna change over relay, receiver muting, and push-to-talk voice operation are also provided.

1-4. Modulator-Power Supply MD-141/GR (or MD-141A/GR) is a combined modulator-power supply designed to supply all a-c and d-c voltages required to operate the transmitter. The two models differ only in the value of permissible duty cycle, governed by line adjustment transformer T202. Modulator-Power Supply MD-141/GR requires intermittent operation, while Modulator-Power Supply MD-141A/GR is designed for continuous operation. All information given in this handbook is applicable to either model.

SECTION II

SPECIAL OVERHAUL TOOLS AND TEST EQUIPMENT

2-1. SPECIAL TOOLS.

2-2. A pair of Waldes No. 2 pliers is required for the overhaul of this equipment. It is used to remove Waldes retaining rings from shafts, as described in section IV of this handbook.

2-3. SPECIAL TEST EQUIPMENT.

2-4. Although the test unit to be described may not be found in an overhaul shop, it is recommended that such a unit be constructed. It will aid in the electrical inspection of a completely assembled modulator-power supply and/or transmitter, following repairs and/or reassembly. A test unit is shown in figure 2-1, and its front panel layout is given in figure 2-2. The test unit fulfills the following functions:

a. Permits testing of a modulator-power supply by simulating the load presented by a transmitter.

b. Permits measuring of all voltages and currents required to energize a transmitter unit.

c. Permits testing of a transmitter by feeding it through the test unit from a modulator-power supply known to be good. The meter readings on the test unit will aid in isolating trouble within a faulty transmitter.

2-5. ELECTRICAL PARTS REQUIRED FOR TEST UNIT. Most of the electrical items required to construct the test unit may be obtained from depot stock parts. Table 2-1 describes each part and gives its symbol number (as found on schematic diagram, figure 2-3). It is permissable to make substitutions if the electrical values are not changed. Resistor wattage ratings can be reduced fifty percent if forced air cooling (10-inch fan or larger) is used to remove heat generated by the resistors at the rear of the test unit. Mount and wire all parts with great care. Use short leads, so dressed as to reduce the possibility of arcing between points having a difference in potential. Power resistors should be mounted in a manner which permits good air circulation.

2-6. CABLE FABRICATION.

2-7. Three specially fabricated cables are required to interconnect the transmitter and modulator-power supply. Except for their length, they are similar in construction to the cables furnished with the equipment. Their extra length permits moving the transmitter and modulator-power supply around at will while trouble shooting the equipment on a workbench. In addition, the special cables are required for connecting a modulator-power supply to the test unit described in paragraph 2-4. Two identical sets of special cables (total of six cables) are required if the transmitter is also connected to the test unit. Each set of special cables includes one special power cable assembly (paragraph 2-8) and two special r-f cable assemblies (paragraph 2-9).

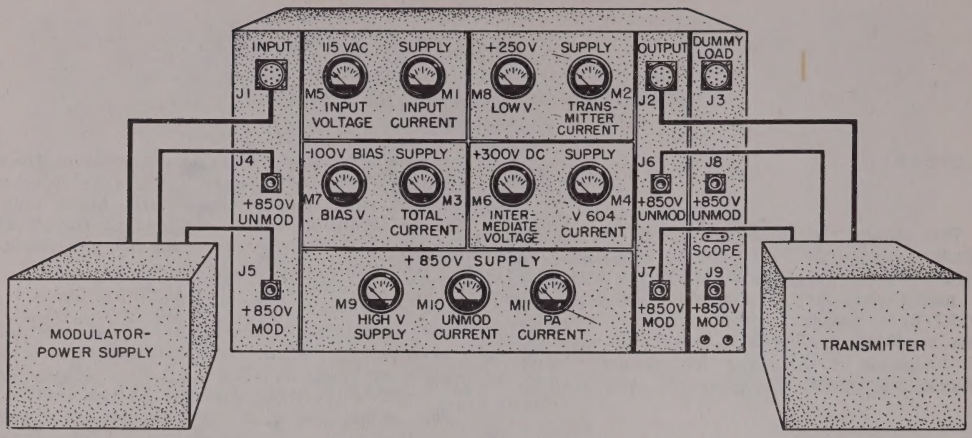
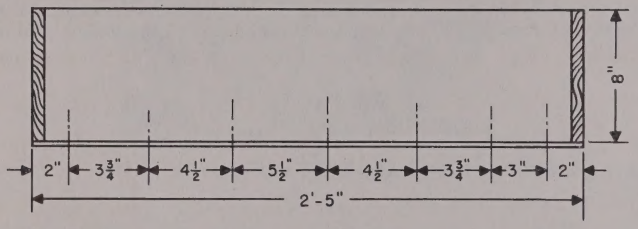


Figure 2-1. Test Unit. Front View and Cable Connections



HOLE SCHEDULE

A = 2¾" DIA — 11 HOLES
B = 1 13/16" DIA — 3 HOLES
C = 1 1/32" DIA — 6 HOLES
D = NO. 8 DRILL — 2 HOLES
E = NO. 17 DRILL — 12 HOLES
F = NO. 31 DRILL — 24 HOLES
G = ¼" DIA — 2 HOLES

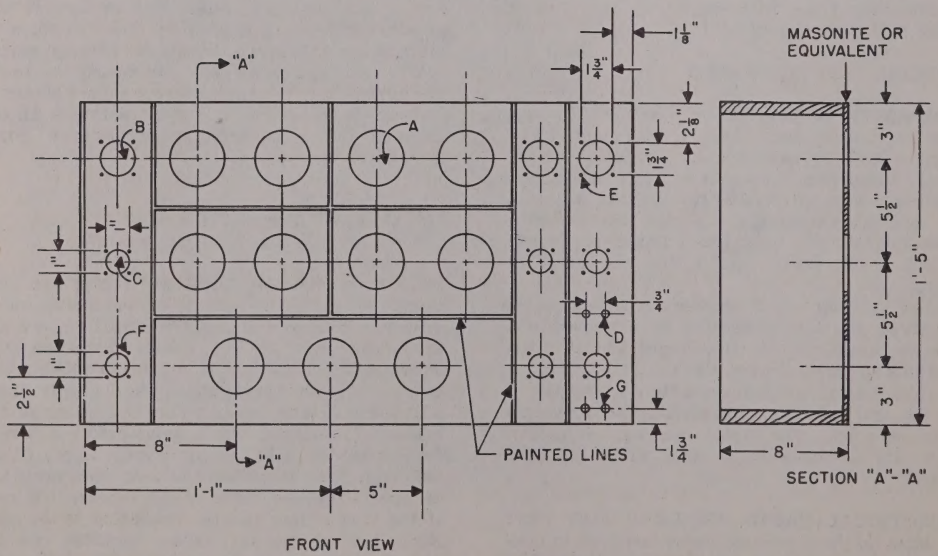


Figure 2-2. Test Unit, Front Panel Layout

TABLE 2-1. ELECTRICAL PARTS LIST FOR TEST UNIT

Quantity	Symbol	Description	Mfr or JAN Designation
1	C1	Capacitor, fixed: mica; 270 uuf ±10%, 1,500 vdcw	CM61E271K per JAN-C-5
1	C2	Capacitor, fixed: paper, 1 uf ±10%, 600 vdcw	CP70B1EF105K per JAN-C-25
1	E1	Terminal assembly, two post	National type FWH or equal
2	J1, J3	Connector: 14 contact male panel jack	AN3102A-32-4P per MIL-C-5015
1	J2	Connector: 14 contact female panel jack	AN3102A-32-4S per MIL-C-5015
4	J4, J5, J8, J9	Connector: single contact male panel jack	AN3102A-18-16P per MIL-C-5015
2	J6, J7	Connector: single contact female panel jack	AN3102A-18-16S per MIL-C-5015
1	J10	Connector: single contact female pin jack; black	IPC type 225, or equal
1	J11	Connector: single contact female pin jack; red	IPC type 225, or equal
1	M1	Meter: 0-5 amp ac, 3-1/2 inch panel mounting	MR35W005ACAA per MIL-M-6A
2	M2, M4	Meter: 0-200 ma dc, 3-1/2 inch panel mounting	MR35W200DCMA per MIL-M-6A
1	M3	Meter: 0-100 ma dc, 3-1/2 inch panel mounting.	MR35W100DCMA per MIL-M-6A
1	M5	Meter: 0-150 V ac, 3-1/2 inch panel mounting	MR35W150ACVV per MIL-M-6A
2	M6, M8	Meter: 0-500 V dc, 3-1/2 inch panel mounting	MR35W500DCVV per MIL-M-6A
1	M7	Meter: 0-200 V dc, 3-1/2 inch panel mounting	MR35W200DCVV per MIL-M-6A
1	M9	Meter: 0-1 kv dc, 3-1/2 inch panel mounting	MR35W001DCKV per MIL-M-6A
2	M10, M11	Meter: 0-500 ma dc, 3-1/2 inch panel mounting	MR35W500DCMA per MIL-M-6A
1	P1	Connector: 14 contact male cable plug	AN3108B-32-4P per MIL-C-5015
1	P2	Connector: 14 contact female cable plug	AN3108B-32-4S per MIL-C-5015
2	P3, P4	Connector: single contact male cable plug	AN3108B-18-16P per MIL-C-5015
2	P5, P6	Connector: single contact female cable plug	AN3108B-18-16S per MIL-C-5015

Continued on the next page

TABLE 2-1. ELECTRICAL PARTS LIST FOR TEST UNIT (CONT)

Quantity	Symbol	Description	Mfr or JAN Designation
4	R1, R2, R3, R4	Resistor, fixed: wirewound; 280 ohms, 140 w	RW10G281 per JAN-R-26A
1	R5	Resistor, fixed: wirewound; 4,000 ohms, 40 w	RW14G402 per JAN-R-26A
1	R6	Resistor, fixed: wirewound; 3,100 ohms, 40 w	RW14G312 per JAN-R-26A
6	R7, R8, R9, R10, R11, R12	Resistor, fixed: composition; 10,000 ohms ±10%, 2 w	RC42BF103K per JAN-R-11
2	R13, R14	Resistor, fixed: wirewound; 9,000 ohms, 140 w	RW10G902 per JAN-R-26A
3	R15, R16, R17	Resistor, fixed: wirewound; 8,000 ohms, 140 w	RW10G802 per JAN-R-26A
1	R18	Resistor, fixed: wirewound; 330 ohms, 40 w	RW14G331 per JAN-R-26A

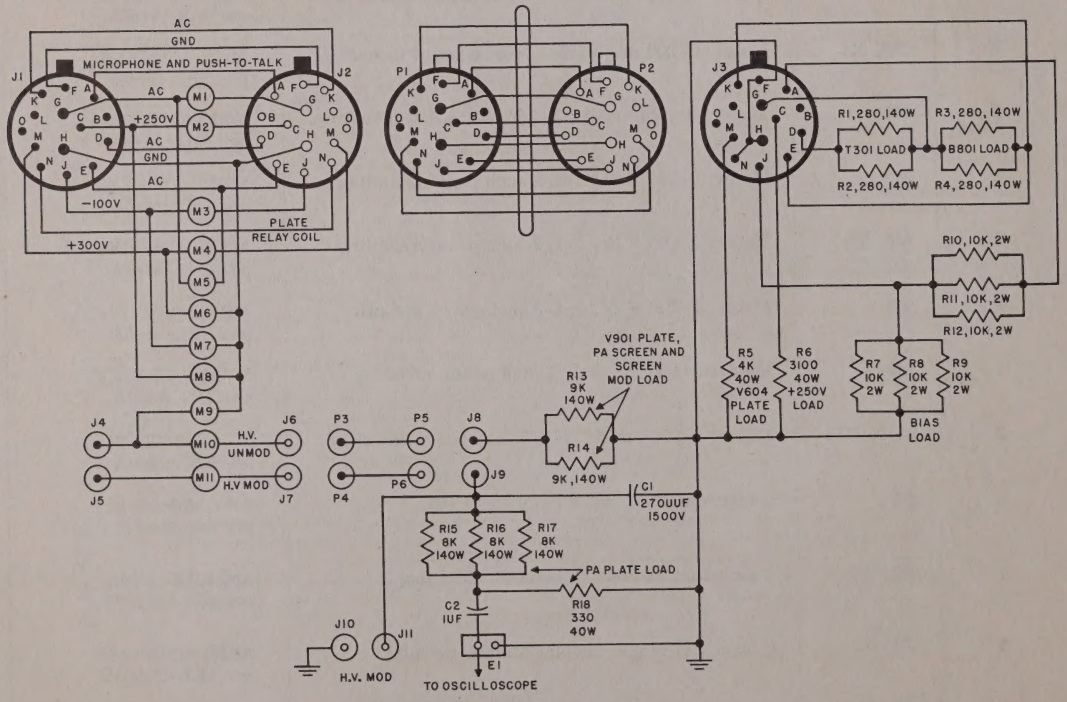
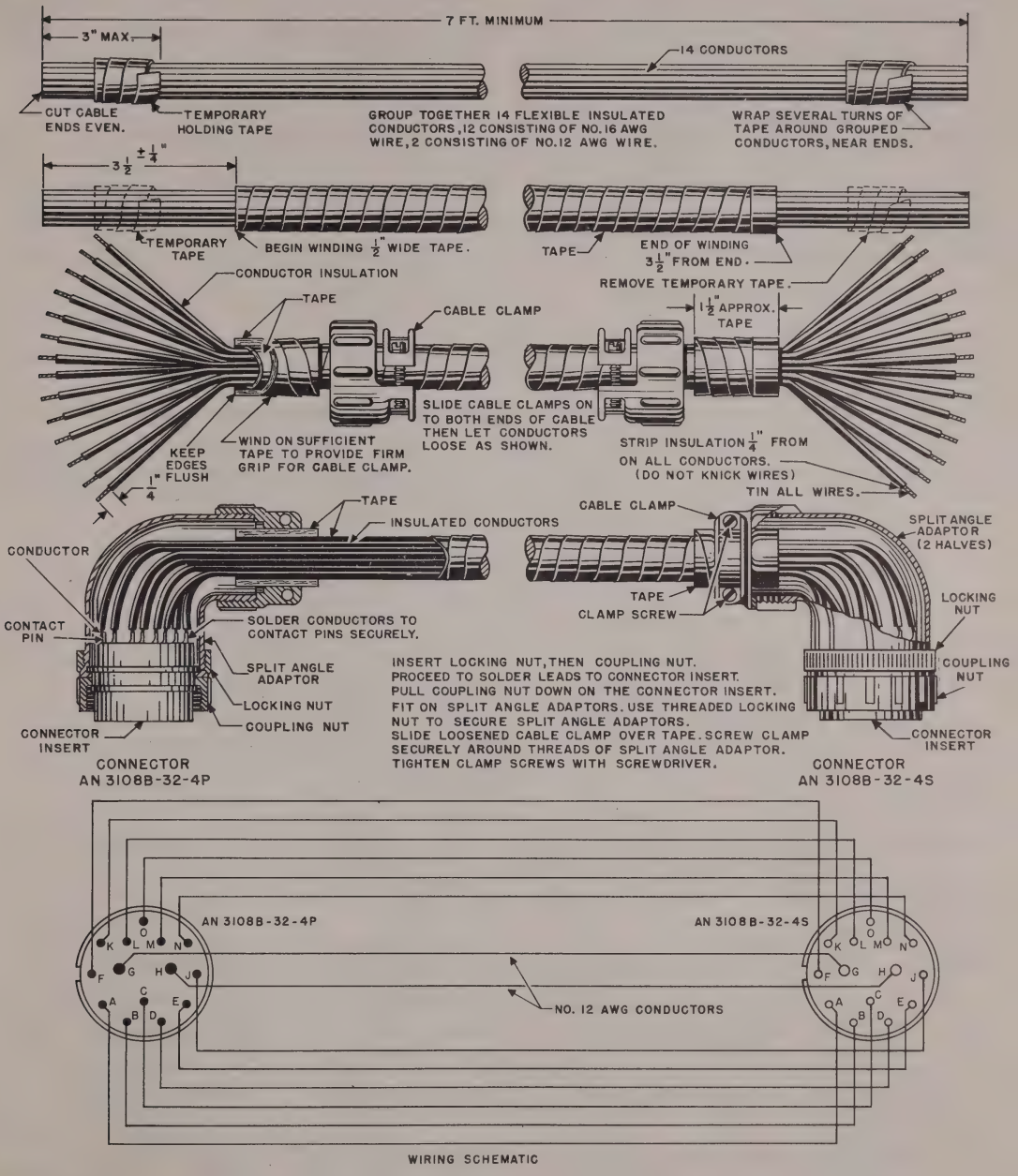


Figure 2-3. Test Unit, Schematic Diagram


7 FT. MINIMUM
3" MAX.
14 CONDUCTORS
CUT CABLE ENDS EVEN.
TEMPORARY HOLDING TAPE
GROUP TOGETHER 14 FLEXIBLE INSULATED CONDUCTORS, 12 CONSISTING OF NO. 16 AWG WIRE, 2 CONSISTING OF NO. 12 AWG WIRE.
WRAP SEVERAL TURNS OF TAPE AROUND GROUPED CONDUCTORS, NEAR ENDS.
3½ ± ¼"
TEMPORARY TAPE
BEGIN WINDING ½" WIDE TAPE.
TAPE
END OF WINDING 3½" FROM END.
REMOVE TEMPORARY TAPE.
CONDUCTOR INSULATION
TAPE
CABLE CLAMP
1½" APPROX. TAPE
SLIDE CABLE CLAMPS ON TO BOTH ENDS OF CABLE THEN LET CONDUCTORS LOOSE AS SHOWN.
KEEP EDGES FLUSH
¼"
WIND ON SUFFICIENT TAPE TO PROVIDE FIRM GRIP FOR CABLE CLAMP.
STRIP INSULATION ¼" FROM ON ALL CONDUCTORS. (DO NOT KNICK WIRES)
TIN ALL WIRES.
TAPE
INSULATED CONDUCTORS
CABLE CLAMP
SPLIT ANGLE ADAPTOR (2 HALVES)
CONDUCTOR
CONTACT PIN
SOLDER CONDUCTORS TO CONTACT PINS SECURELY.
TAPE
CLAMP SCREW
LOCKING NUT
COUPLING NUT
SPLIT ANGLE ADAPTOR
LOCKING NUT
COUPLING NUT
CONNECTOR INSERT
INSERT LOCKING NUT, THEN COUPLING NUT.
PROCEED TO SOLDER LEADS TO CONNECTOR INSERT.
PULL COUPLING NUT DOWN ON THE CONNECTOR INSERT.
FIT ON SPLIT ANGLE ADAPTORS. USE THREADED LOCKING NUT TO SECURE SPLIT ANGLE ADAPTORS.
SLIDE LOOSENED CABLE CLAMP OVER TAPE. SCREW CLAMP SECURELY AROUND THREADS OF SPLIT ANGLE ADAPTOR.
TIGHTEN CLAMP SCREWS WITH SCREWDRIVER.
CONNECTOR INSERT
CONNECTOR AN 3108B-32-4P
CONNECTOR AN 3108B-32-4S
AN 3108B-32-4P
AN 3108B-32-4S
K L M N F G H J A B C D E
NO. 12 AWG CONDUCTORS
WIRING SCHEMATIC

NOTE:
ASSEMBLY AND CABLE STRIPPING PROCEDURE IS THE SAME FOR BOTH ENDS.

Figure 2-4. Fabrication of Special Power Cable Assembly

2-8. SPECIAL POWER CABLE ASSEMBLY. (See figure 2-4.) The illustration gives fabrication instructions and material requirements for a cable to replace power cable assembly CX-2017/U. One such cable is required for each set of special cables.

2-9. SPECIAL R-F CABLE ASSEMBLY. (See figure 2-5.) The illustration gives fabrication instructions and material requirements for cables to replace r-f cable assemblies CG-693/U. Two identical cables are required (per set of special cables). One cable interconnects the "HV MOD" connectors and the other cable interconnects the "HV UNMOD" connectors on the rear of the transmitter and modulator-power supply units.

2-10. FOUR-MC TRANSFORMER ASSEMBLY.

2-11. The special 4-mc transformer assembly is required when adjusting the transmitter for optimum modulation linearity. The secondary circuit of the assembly is tuned to the beat note (difference frequency) between the output of the transmitter and an r-f signal generator; the signal generator is tuned to a frequency, differing from that of the transmitter, by approximately 4 mc. Figure 2-6 includes the schematic diagram of the assembly as well as construction details and material requirements.

2-12. SPECIAL CRYSTALS. Four type CR-27/U crystals are required for testing and aligning the transmitter. The frequency of the crystals and the resultant transmitter output frequency is given in Table 2-2.

TABLE 2-2. SPECIAL CRYSTALS

Crystal Freq (in Mc)	Transmitter Freq (in Mc)
6.06	218
6.25	225
7.00	252
11.11	400
11.39	410

2-13. RECOMMENDED TEST EQUIPMENT.

2-14. Table 2-3 lists recommended test equipment for the overhaul of this equipment. This is in addition to the special test equipment given in paragraphs 2-3 through 2-12.

TABLE 2-3. RECOMMENDED TEST EQUIPMENT FOR OVERHAUL

Name	Mfr Designation	Alternate	Application
Distortion Analyzer	Hewlett-Packard Model 330B	General Radio Type 736-A	Measure audio distortion
Audio Signal Generator	Hewlett-Packard Model 206A	General Radio Type 1303-A	Audio response and distortion
Cathode Ray Oscilloscope	Dumont No. 303	RCA WO-79A	Check modulation linearity
Microphone	T-17		Check modulation
A-C Vacuum Tube Voltmeter	Ballantine Model 300	Hewlett-Packard Model 400C	Measure audio voltages
Voltage Multiplier	Ballantine Model 1300A (use only with Ballantine Model 300)	Hewlett-Packard Model 454A (use only with Hewlett-Packard Model 400C)	Extend range of A-C Voltmeter
Variac	Superior Electric Powerstat Type 1226	General Radio Type V-20HM	Vary input voltage
A-C Voltmeter	General Electric No. AP-9	Weston Model 433	Measure line voltage input
A-C Ammeter	General Electric No. AP-9	Weston Model 433	Measure line current input
Wattmeter	General Electric No. AP-9	Weston Model 432	Measure input wattage
Multimeter	Triplett Model 630-A	Simpson Model 260	Measure a-c and d-c voltages

Continued on the next page

TABLE 2-3. RECOMMENDED TEST EQUIPMENT FOR OVERHAUL (CONT)

Name	Mfr Designation	Alternate	Application
Coaxial Resistor	M. C. Jones Model 631	Bird Electronic Corp, Terminal Model 82	Dummy antenna
RF Wattmeter	M. C. Jones Model MM 562		Measure transmitter r-f power output
RF Wattmeter	M. C. Jones Model MM 560		Measure exciter r-f power output
VHF Signal Generator	Hewlett-Packard Model 608A	General Radio Type 1021-AU	Check modulation linearity
Mixer Rectifier	General Radio Type 874-MR		Convert carrier to 4 mc
Adaptor (two required)	General Radio Type 841-Q1		For r-f connector interconnection
Adaptor	JAN type UG-29B/U	JAN type UG-29A/U	For r-f connector interconnection
Patch Cord	General Radio Type 874-R32		Interconnecting cable for modulation check

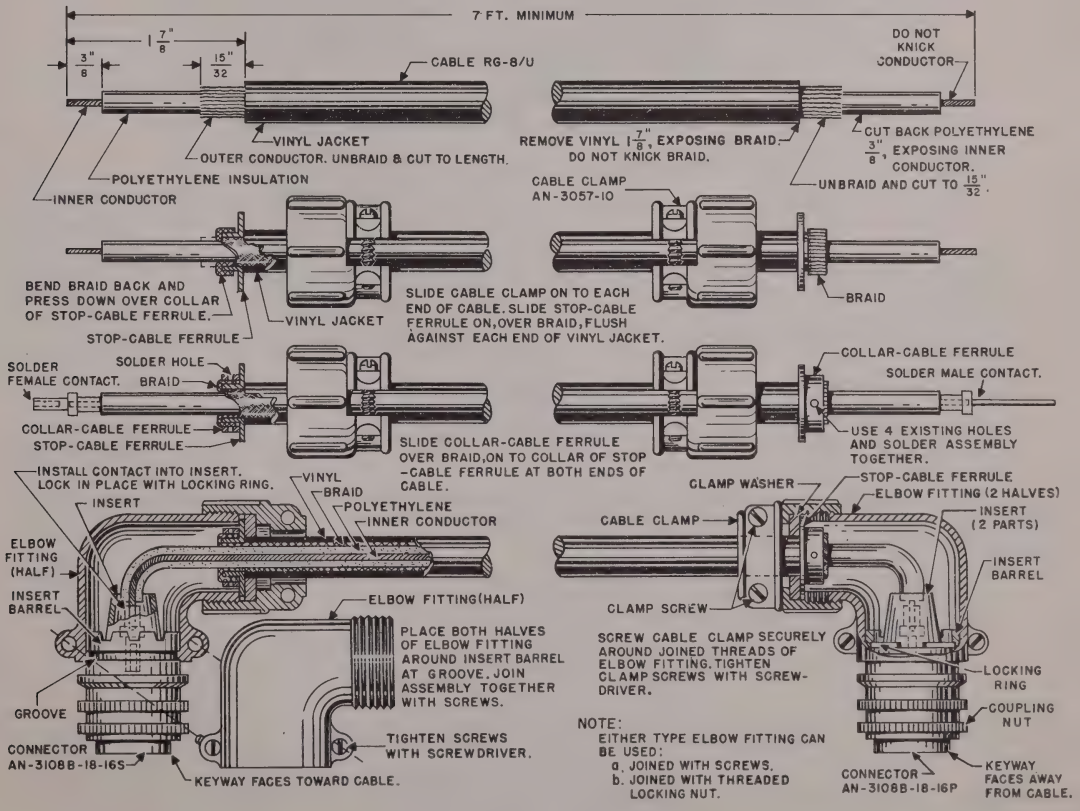

7 FT. MINIMUM
1 7/8"
3/8"
15/32"
CABLE RG-8/U
DO NOT KNICK CONDUCTOR
VINYL JACKET
OUTER CONDUCTOR. UNBRAID & CUT TO LENGTH.
REMOVE VINYL 1 7/8", EXPOSING BRAID. DO NOT KNICK BRAID.
CUT BACK POLYETHYLENE 3/8", EXPOSING INNER CONDUCTOR.
POLYETHYLENE INSULATION
INNER CONDUCTOR
CABLE CLAMP AN-3057-10
UNBRAID AND CUT TO 15/32".
BEND BRAID BACK AND PRESS DOWN OVER COLLAR OF STOP-CABLE FERRULE.
VINYL JACKET
STOP-CABLE FERRULE
SLIDE CABLE CLAMP ON TO EACH END OF CABLE. SLIDE STOP-CABLE FERRULE ON, OVER BRAID, FLUSH AGAINST EACH END OF VINYL JACKET.
BRAID
SOLDER FEMALE CONTACT.
SOLDER HOLE
BRAID
COLLAR-CABLE FERRULE
STOP-CABLE FERRULE
SLIDE COLLAR-CABLE FERRULE OVER BRAID, ON TO COLLAR OF STOP-CABLE FERRULE AT BOTH ENDS OF CABLE.
COLLAR-CABLE FERRULE
SOLDER MALE CONTACT.
USE 4 EXISTING HOLES AND SOLDER ASSEMBLY TOGETHER.
INSTALL CONTACT INTO INSERT. LOCK IN PLACE WITH LOCKING RING.
INSERT
VINYL
BRAID
POLYETHYLENE
INNER CONDUCTOR
ELBOW FITTING (HALF)
INSERT BARREL
GROOVE
CONNECTOR AN-3108B-18-16S
KEYWAY FACES TOWARD CABLE.
ELBOW FITTING(HALF)
PLACE BOTH HALVES OF ELBOW FITTING AROUND INSERT BARREL AT GROOVE. JOIN ASSEMBLY TOGETHER WITH SCREWS.
TIGHTEN SCREWS WITH SCREWDRIVER.
CLAMP WASHER
STOP-CABLE FERRULE
ELBOW FITTING (2 HALVES)
CABLE CLAMP
INSERT (2 PARTS)
INSERT BARREL
CLAMP SCREW
SCREW CABLE CLAMP SECURELY AROUND JOINED THREADS OF ELBOW FITTING. TIGHTEN CLAMP SCREWS WITH SCREWDRIVER.
LOCKING RING
COUPLING NUT
NOTE:
EITHER TYPE ELBOW FITTING CAN BE USED:
a. JOINED WITH SCREWS.
b. JOINED WITH THREADED LOCKING NUT.
CONNECTOR AN-3108B-18-16P
KEYWAY FACES AWAY FROM CABLE.

Figure 2-5. Fabrication of Special R-F Cable Assembly

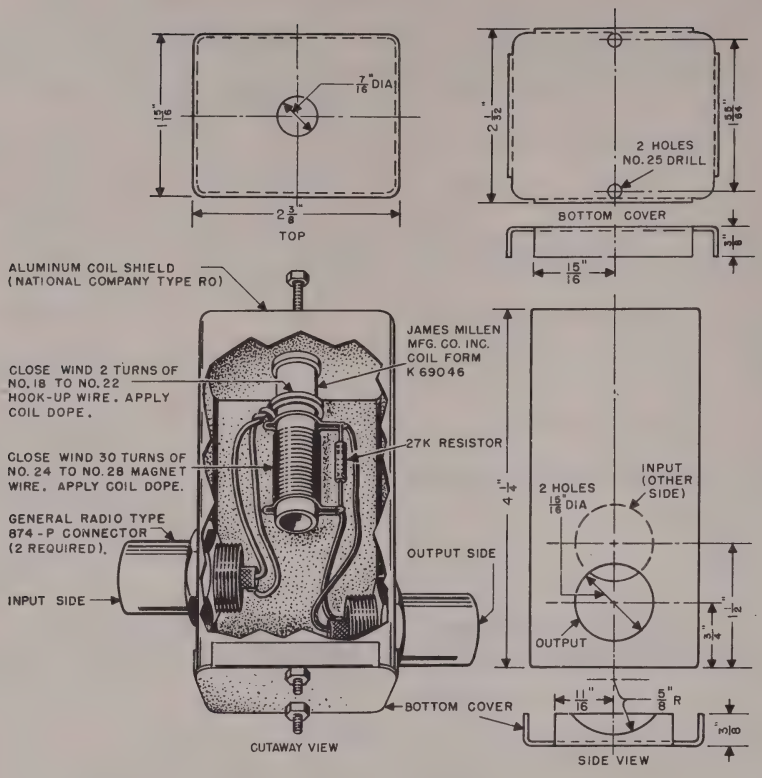

7/16" DIA
TOP
2 HOLES NO. 25 DRILL
BOTTOM COVER
ALUMINUM COIL SHIELD (NATIONAL COMPANY TYPE RO)
JAMES MILLEN MFG. CO. INC. COIL FORM K 69046
CLOSE WIND 2 TURNS OF NO. 18 TO NO. 22 HOOK-UP WIRE. APPLY COIL DOPE.
27K RESISTOR
CLOSE WIND 30 TURNS OF NO. 24 TO NO. 28 MAGNET WIRE. APPLY COIL DOPE.
GENERAL RADIO TYPE 874-P CONNECTOR (2 REQUIRED).
INPUT SIDE
OUTPUT SIDE
2 HOLES 15/16" DIA
INPUT (OTHER SIDE)
OUTPUT
BOTTOM COVER
CUTAWAY VIEW
SIDE VIEW

Figure 2-6. Fabrication of Special 4-MC Transformer Assembly

SECTION III

SPECIALIZED MAINTENANCE AND REPAIR

3-1. No data, other than that supplied in the applicable Handbook of Service Instructions, is required for specialized maintenance and repair of this equipment.

SECTION IV

DISMANTLING AND DISASSEMBLY

4-1. GENERAL.

4-2. Instructions for disassembly of the gears and other linkages that comprise the tuning mechanism of the transmitter are given in Table 4-1. Step-by-step procedures for removing the power-supply and modulator chassis from the modulator-power supply are given in the applicable Handbook of Service Instructions. The same handbook also gives instructions for separating the front and rear sections of the transmitter, as well as removal of the exciter and monitor-screen modulator assemblies, and removal of the transmitter blower motor.

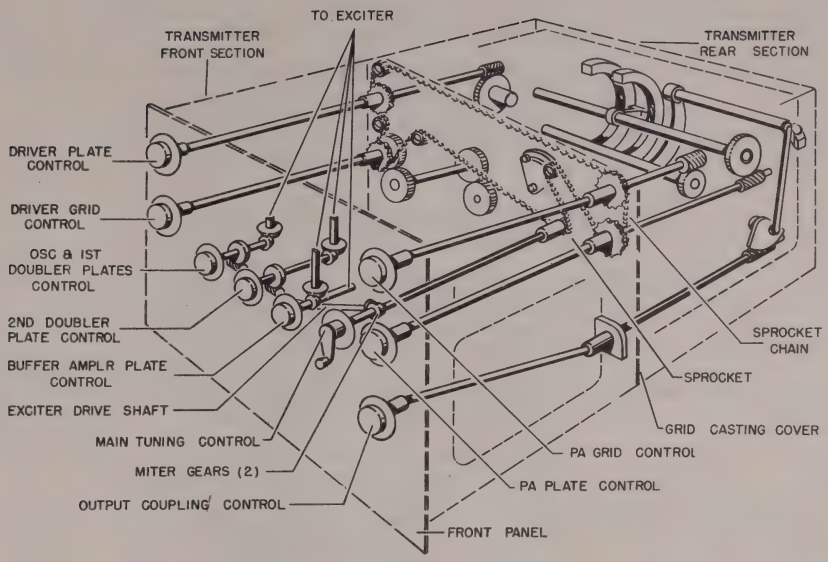


Figure 4-1. Transmitter, Over-all Tuning Mechanism

4-3. DISASSEMBLY OF TRANSMITTER TUNING MECHANISM. The tuning mechanism of this equipment (see figure 4-1) does not require periodic overhaul. Perform only those portions of the disassembly procedure, given in Table 4-1, which are required to replace damaged parts. Do not lose washers and other small parts. Reassemble one set of parts before disassembling additional items.

NOTE

For alignment instructions following reassembly, refer to Section VIII of this handbook and Section VI of the applicable Handbook of Service Instructions.

TABLE 4-1. DISASSEMBLY OF TRANSMITTER TUNING MECHANISM

Control	Location	Procedure	Remarks
PA GRID	Front section, right side.	1. Loosen set-screws (item 1), in both universals (2). Remove shaft (3) and universals. 2. Remove chain sprocket (4) by loosening set-screws (5) in adjacent collar (6).	See figure 4-2. Set-screws require No. 6 Bristo wrench which is secured in clip, right side, rear section of transmitter.
	Rear section, right side.	1. Loosen set-screws (7) and remove worm gear (8). 2. Carefully drive out roll pin (9) from worm (10) and pull worm off rear shaft (11). 3. To remove rear shaft, loosen set-screws in collar (12), remove collar (13), and pull shaft forward (through grid casting cover (14)).	

Continued on the next page

TABLE 4-1. DISASSEMBLY OF TRANSMITTER TUNING MECHANISM (CONT)

Control	Location	Procedure	Remarks
PA PLATE	Front section, right side.	1. Loosen set-screws (15) in both universals (16). Remove shaft (17) and universals. 2. Remove chain sprocket (18) by loosening set-screws (19) in adjacent collar (20).	See figure 4-2. Set-screws require No. 6 Bristo wrench.
	Rear section, right side.	1. Loosen set-screws (21) in flexible shaft end fittings (22) and remove flexible shaft (23). 2. Loosen set-screws (24) and remove worm wheel (25). 3. Carefully drive out roll pin (26) from worm (27), remove end collar (28) secured with set-screws (29), pull worm shaft (30) forward, slip worm off worm shaft.	
OUTPUT COUPLING	Front section, right side.	1. Loosen set-screws (31) in both universals (32). Remove shaft (33) and universals. 2. Loosen set-screws (34) and remove collar (35) adjacent to grid casting cover (14).	See figure 4-2. Set-screws require No. 6 Bristo wrench.
	Rear section, right side.	1. Loosen set-screws (36) in flexible shaft end fitting (37) and remove flexible shaft (38). 2. Detach link (39) from worm wheel sector (40); secured with shouldered screw (41) and nut (42). 3. Remove worm wheel sector, secured with shouldered screw shaft (43) and nut (44); to gain access to nut, remove rear air filter and larger of the two radiation screens. 4. Carefully drive out roll pins (45) from worm (46) and stop collar (47). 5. Loosen set-screws (48) and remove end collar (49). Pull shaft (50) forward so as to remove worm and stop collar.	
MAIN TUNING	Front section, right side.	1. Loosen set-screws (51) in both universals (52). Remove shaft (53) and universals. 2. Loosen set-screws (54) in collar of chain sprocket (55). Remove sprocket, taking care that shaft (56) does not fall back through grid casting cover (14). 3. Remove cable clamp (57), secured by holding screw (58), from main tuning gear bracket assembly (59). 4. Loosen set-screws (60) in MAIN TUNING handle (61). 5. Remove monitor-screen modulator assembly; disconnect flexible shaft (62) from shaft which protrudes through main tuning gear bracket (63) (set-screws in flexible shaft end fitting (64)).	See figure 4-2. Set-screws require No. 6 Bristo wrench.

Continued on the next page

TABLE 4-1. DISASSEMBLY OF TRANSMITTER TUNING MECHANISM (CONT)

Control	Location	Procedure	Remarks
MAIN TUNING (cont)		6. Remove three front panel set-screws (grouped around MAIN TUNING dial) which secure main tuning gear bracket assembly to front panel. Remove assembly from transmitter. 7. Loosen set-screw (65) and remove stop collar (66). Remove stop plates (67). 8. Carefully drive out roll pins (68) from the two miter gears (69) and from the adjacent collar. 9. Pull MAIN TUNING control shaft (70) through bracket sleeve bearings; remove miter gears, collar, and shaft.	
DRIVER PLATE	Front section, left side.	1. Loosen set-screws (item 1), in both universals (2). Remove shaft (3) and universals. 2. Remove chain sprocket (4) by loosening set-screws (5) in adjacent collar (6).	See figure 4-3. Set-screws require No. 6 Bristo wrench.
	Rear section, left side.	1. Loosen set-screws (7) in flexible shaft end fitting (8) and remove flexible shaft (9). 2. Loosen set-screws (10) and remove worm wheel (11). 3. Carefully drive out roll pin (12) from worm (13), remove end collar (14), secured with set screws (15), pull worm shaft forward (16), slip off worm shaft, taking care not to lose flat washer.	
DRIVER GRID	Front section, left side.	1. Loosen set-screws (17) in both universals (18). Remove shaft (19) and universals. 2. Remove chain sprocket (20) by loosening set-screws (21) in adjacent collar (22). 3. Loosen set-screws (23) and remove collar (24) at rear of grid casting cover (25); pull driver spur gear (26), forward on shaft (27) to disengage from grid casting cover. 4. Carefully drive out steel stop pin (28) from driver spur gear and pull off shaft. 5. Loosen set-screws (29) and remove driven spur gear (30).	See figure 4-3. Set-screws require No. 6 Bristo wrench.

Continued on the next page

TABLE 4-1. DISASSEMBLY OF TRANSMITTER TUNING MECHANISM (CONT)

Control	Location	Procedure	Remarks
BUFFER AMPLR PLATE	Atop exciter subassembly.	1. Remove Waldes retaining ring (item 1) at either end of shaft (2); use Waldes No. 2 pliers. 2. Carefully drive out roll pins (3) from gears (4). Pull shaft through sleeve bearing (5) and remove gears.	Removal of exciter subassembly from transmitter required (see Handbook of Service Instructions). See figure 4-4.
Exciter Worm Shaft	Atop exciter subassembly, parallel to front panel.	1. Carefully drive out roll pins (6) from the two worms (7). 2. Remove Waldes retaining ring (8) at right end of shaft (9); use Waldes No. 2 pliers. Pull shaft through sleeve bearing (10), slip worms off shaft, and remove exciter worm shaft.	Removal of exciter subassembly from transmitter required (see Handbook of Service Instructions). See figure 4-4.
2ND DOUBLER PLATES	Atop exciter subassembly.	1. After removal of exciter worm shaft, drive out roll pins (11) from both beveled gears (12). Loosen Waldes retaining ring (13), near smaller of the two gears, with Waldes No. 2 pliers and pull shaft (14) forward so gears can be disengaged and removed. 2. Drive out roll pin (15) from stop collar (16). 3. Remove front Waldes retaining ring (17); use Waldes No. 2 pliers. 4. Pull shaft through front sleeve bearing (18), slide collar and gear (19) off shaft.	1. Removal of exciter subassembly from transmitter required (see Handbook of Service Instructions). 2. When reassembling parts, replace shaft with new one not drilled at rear end (for tapered pin); drill during exciter alignment (see paragraph 8-12). 3. See figure 4-4.
OSC & 1ST DOUBLER PLATES	Atop exciter subassembly.	1. After removal of exciter worm shaft, drive out roll pins (20) from both beveled gears (21). Loosen Waldes retaining ring (22), near smaller of the two gears, with Waldes No. 2 pliers and pull shaft (23) forward so gears can be disengaged and removed. 2. Drive out roll pin (24) from stop collar (25). 3. Remove front Waldes retaining ring (26); use Waldes No. 2 pliers. 4. Pull shaft through front sleeve bearing (27), (loosen Waldes retaining ring next to gear (28)), slide stop collar and gear (29) off shaft.	1. Removal of exciter subassembly from transmitter required (see Handbook of Service Instructions). 2. When reassembling parts, replace shaft with one not drilled at rear end (for tapered pin); drill during alignment (see paragraph 8-12). 3. See figure 4-4.

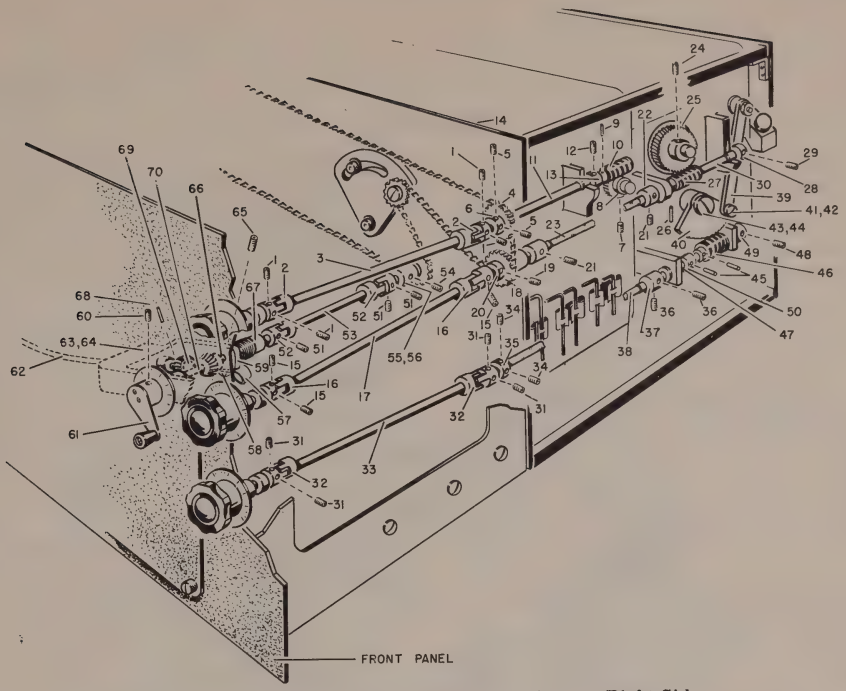


Figure 4-2. Transmitter, Tuning Mechanism on Right Side

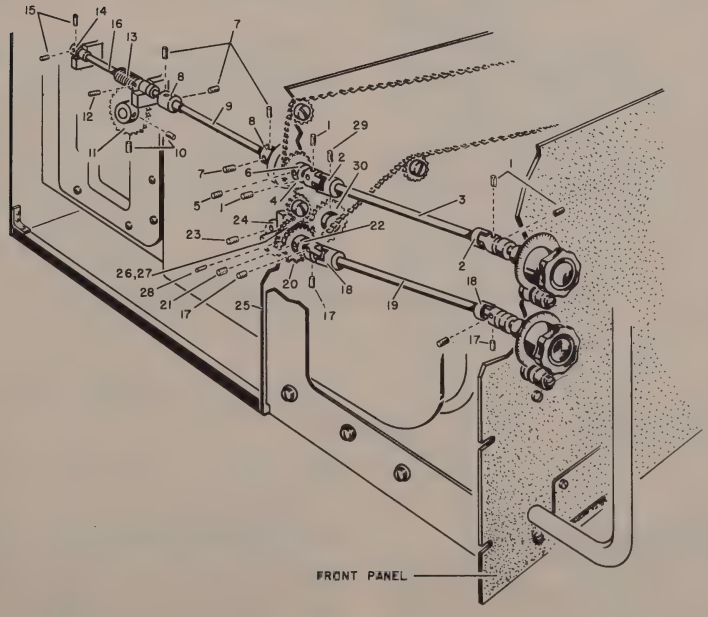


Figure 4-3. Transmitter, Tuning Mechanism on Left Side

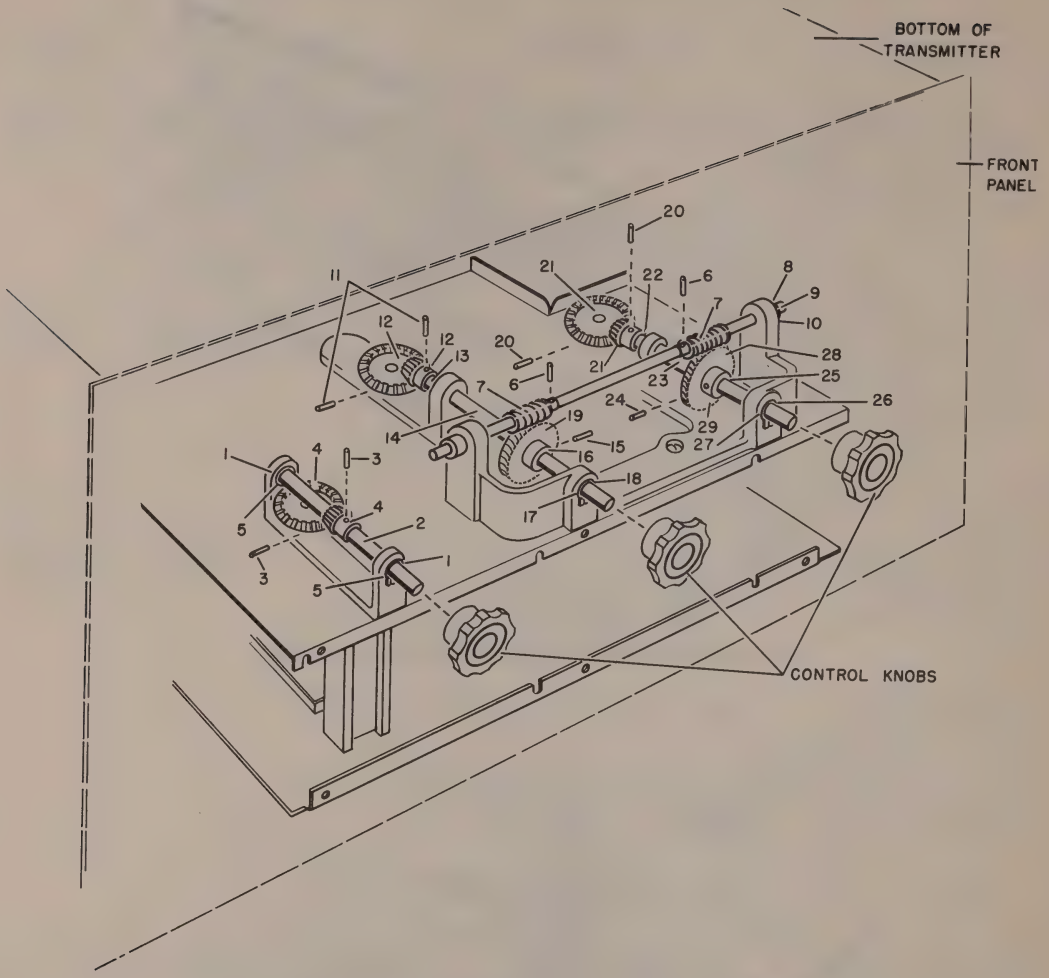


Figure 4-4. Exciter Subassembly, Tuning Mechanism

SECTION V

CLEANING

5-1. CLEANING OF TRANSMITTER AND MODULATOR-POWER SUPPLY.

5-2. This equipment is furnished with dust covers and air filters to minimize the penetration of dust, and does not normally require any attention beyond that specified in the Handbook of Service Instructions. Clean all tubes, chassis, and mechanical parts with a brush or cloth dipped in carbon tetrachloride. Dust all wiring with a dry brush, taking care not to disturb the position of parts or lead dress. If corroded, clean tube and crystal prongs, as well as fuse ends, with crocus cloth, and wipe with clean cloth.

SECTION VI

INSPECTION

6-1. INSPECTION OF ELECTRICAL COMPONENTS.

6-2. Visual inspection of electrical components of the equipment includes the items listed below. This inspection is to be followed by a detailed check-off procedure as given in paragraphs 6-3 through 6-22. Start the inspection by checking the following:

a. Examine pins and sockets of all tubes, relays, and crystals, for loose contacts, dirt, and corrosion.

b. Inspect capacitor terminals for corrosion.

c. Examine resistors for blistering, discoloration, and other evidence of overheating.

d. Examine wires, cords, and cables for cracked, cut, or frayed insulation.

e. Examine sealed components, such as transformers and capacitors, for leakage.

6-3. INSPECTION OF MECHANICAL COMPONENTS.

6-4. The following paragraphs represent mechanical inspection check-off lists, similar to the ones used by the manufacturer. Refer to the applicable Parts Catalog for detailed information on the location and method of assembly of all items, including hardware. Inspection of units is sectional as designated below. Paragraphs 6-5 through 6-14 refer to the modulator-power supply, and paragraphs 6-15 through 6-22 apply to the transmitter.

6-5. MODULATOR-POWER SUPPLY MECHANICAL INSPECTION.

6-6. Use the following list to inspect the outside of the front panel. Check each section fully before proceeding with the next item. Refer to paragraph 6-11 for the inspection procedure required to check the rear of this panel.

a. HARDWARE FINISH. Mounting hardware must be painted with the exception of hardware on access panels which is brass nickel plated. Hardware must be tightly fastened and free of burrs. Check for flat and lock washers in proper places.

b. PAINT FINISH. Panel face and edges should be clean. There must be no signs of scratches, chipped edges or defacement by foreign matter.

c. NAMEPLATE. Nameplate must show no sign of looseness.

d. AUXILIARY PANEL ASSEMBLY. Auxiliary panel assembly must be securely mounted to front panel by fourteen mounting screws with a lockwasher under each head.

e. PILOT LIGHT ASSEMBLIES. Pilot light caps should be removable without causing complete assembly to rotate. Dimmer must rotate freely from fully open to fully closed position without binding. Color of lens to be green for the POWER light and red for the PLATE light.

f. AIR FILTER ASSEMBLY. Air filter assembly must be securely mounted to front panel by four captive screws. Filter screen must be free from any defacement, such as broken strands or bent areas.

g. TOGGLE SWITCHES. Toggle switches must be tightly mounted. Switches must snap into place at each designated position.

h. KNOB ALIGNMENT AND FINISH. Knob must rotate easily, without binding. Knob must align with the screened limits of calibration at clockwise and counterclockwise extremes of rotation. There should be no signs of cracks or chipped areas.

i. MIKE JACK. Mike jack should be centered in hole of front panel. Mounting hex nut should be glyptalled.

j. MIKE JACK AND LIMITER THRESHOLD COVERS. Springs on cover assemblies must hold cover tightly closed. Rubber seal under cover must be securely attached to inside of cover.

k. TEST POINT COVER PLATE. Plate must be securely mounted by six knurled screws. Chain connecting cover to front panel must be securely fastened.

6-7. OUTSIDE POWER SUPPLY CHASSIS INSPECTION. Use the following list to inspect the bottom of the power supply (left chassis). Check each section fully before proceeding with the next item. Refer to paragraph 6-10 for the procedure for checking the other side of the chassis.

a. HARDWARE FINISH. Hardware should be brass nickel plated, free of burrs, and tightly fastened. Lock washers must be iridited (faint multi-color appearance).

b. SCREENING. Screening of reference symbols must be clear and legible.

c. TUBE SOCKETS. Tube sockets X101, X102, X103, X104, and X105 must be securely fastened to chassis. There should be no signs of cracks or chipped edges on sockets. Bakelite washers and spacers must be in proper places.

d. RESISTOR ASSEMBLIES. Resistor assemblies must be securely mounted to chassis, show no signs of cracks or chips. Check value of resistors. R101 should be 350 ohms, 38 watts (RW35G351); R102 should be 350 ohms, 18 watts (RW33G351).

e. TERMINAL BOARDS. Terminal boards must be fastened to chassis. There should be no signs of cracked or chipped edges on terminal boards. All terminals must be tightly mounted. Hardware must be free of burrs.

f. SOLDERING. Soldered joints must be neat, clean and free of excess rosin or solder. There should be no evidence of sharp points or rough surfaces.

g. LEAD DRESSING. Leads must be neatly dressed in a manner which will eliminate any possibility of arcing due to proximity to components at different potentials. There must be no signs of burnt or split insulation. Check cable clamps for tightness, size and proper location.

6-8. REAR PANEL INSPECTION. Use the following list to inspect the outside of the rear panel assembly.

Inspect each item fully before proceeding with the next item. Refer to paragraph 6-13 for checking the inside of the panel.

a. HARDWARE. Mounting hardware on rear panel should be brass nickel plated and free of burrs. All hardware must be securely fastened. Check for lock washers in proper places.

b. AIR FILTER ASSEMBLY. Air filter assembly must be securely mounted to rear panel by eight captive screws. Paint finish must be clean and show no signs of scratches or chipped edges. Filter screen must be free from any defacement, such as broken strands or bent areas.

c. CONNECTORS. Connectors J501, J502, and J503 must be securely mounted. Check bakelite for looseness, cracks or chips. Check key for proper position. All solder connections on connectors must have insulating sleeves covering the soldered terminals and be properly moisture-fungus proofed.

d. NAMEPLATE. Nameplate must show no sign of looseness.

e. TERMINAL BOARDS. Check terminal boards for cracks or chipped edges.

f. TOGGLE SWITCH. Check toggle switch for tightness. Switch must snap into place at each position.

6-9. OUTSIDE MODULATOR CHASSIS INSPECTION. Use the following list to inspect the bottom of the modulator (right chassis). Check each section fully before proceeding with the next item. Refer to paragraph 6-12 when checking the other side of the chassis.

a. SCREENING. Screening of reference symbols must be clear and legible.

b. HARDWARE. Mounting hardware must be tightly fastened and free of burrs. Check for flat and lock washers in proper places.

c. TUBE SOCKETS. Tube sockets X201 and X202 must show no signs of cracked or chipped edges. Check for broken or loose terminals. Bakelite surface should be free of cracks or chipped edges.

d. TOGGLE SWITCHES. Toggle switches must be securely mounted in a horizontal position. Check for broken or loose terminals. Bakelite surface should be free of cracks or chipped edges.

e. RESISTORS AND RESISTOR BOARDS. All resistors and resistor boards must be mounted in proper position with proper hardware. Bakelite surface should not be scratched, cracked, or have chipped edges. Resistors must show no signs of cracks, chipped, or burnt areas.

f. CABLES. Wires must be neatly and tightly bound into cable. There must be sufficient slack in cable to prevent stress on individual wires or terminals. Check for cable clamps in proper places.

g. SOLDERING. Soldered joints must be neat, clean, and free of excessive rosin or solder. There must be no signs of cold solder, sharp points, or rough surface.

h. LEAD DRESSING. Leads must be neatly dressed in a manner which will eliminate any possibility of arcing due to proximity to components of different potentials. There must be no signs of split or burnt insulation.

6-10. INSIDE POWER SUPPLY CHASSIS INSPECTION. Use the following list to inspect the side of the chassis on which the tubes are mounted. Check each section fully before proceeding with the next item.

a. SCREENING. Screening of reference symbols must be clear and legible.

b. HARDWARE. Mounting hardware must be tightly fastened and of the proper size. There must be no signs of burrs or nicks.

c. TUBES. Tubes V101, V102, V103, and V104 must be tightly seated in sockets. Socket keys should face top of chassis. Plate caps must be tightly mounted on tubes with leads of proper length.

d. RELAYS K101 and O-101 (K102 on units manufactured by Harvey-Wells). Relays must be flush in sockets. Shield on relay K101 must be securely fastened in place. Check for coil spring on inside of K101 shield. Relay O-101 (K102) must be free of scratches and chipped areas on painted surface.

e. AIR INTERLOCK SWITCH. The switch must show no signs of cracks or chipped edges. When arm of switch is moved to the right and released, it should snap back to original position with no signs of binding.

f. TRANSFORMERS AND CHOKES. Transformers and chokes must be securely mounted in place. Paint finish must be clean and show no signs of chips or scratches.

g. GROMMETS. Grommets must show no signs of cuts or tears, and must be properly seated in holes of chassis.

6-11. REAR OF FRONT PANEL INSPECTION. Use the following list when inspecting the rear of the front panel. Check each item fully before proceeding with the next item.

a. SCREENING. Screening of reference symbols must be clear and legible.

b. TOGGLE SWITCHES. Switches must be tightly fastened in place. Check for broken bakelite surface and terminals. Switches must be mounted in a horizontal position.

c. PILOT LIGHTS. Pilot lights must be securely mounted to auxiliary panel with proper hardware. Check for damaged terminals and mountings.

d. GASKETS. Channels containing grounding braid (gasket) must be securely fastened to front panel (four pieces). Bare metal must be free of paint and dirt. Gasket must be seated properly in gasket retainer and must fill corners. Where braid is routed around a corner it must be well packed into said corner with no evidence of being stretched or damaged. Check for rubber gasket between front panel and driver chassis.

e. FRONT ACCESS DOOR. Filter screen must be free of bent or broken areas. Fan assembly must be securely mounted in place. Fan must rotate freely without touching sides of mounting bracket or filter screen.

f. SOLDERING. All soldered joints must be neat, free of rosin, sharp edges, and cold solder.

g. LEAD DRESSING. Leads must be neatly dressed and show no evidence of broken wires, split, or burnt insulation.

6-12. INSIDE MODULATOR CHASSIS INSPECTION. Use the following list to inspect the side of the chassis on which the tubes are mounted. Check each section fully before proceeding with the next item.

a. HARDWARE. All mounting hardware must be tightly fastened, proper size, and free of burrs.
b. SCREENING. Screening of reference symbols must be clear and legible.
c. MODULATOR TUBES. Tubes V201 and V202 must be tightly seated in sockets. Ceramic caps must not be loose or chipped. Wires from cable to plate cap must be sufficient in length to avoid strain on tube caps.
d. DRIVER TUBES. Each driver tube (V301, V302, V303, V304, V305, V306) must be provided with a tube shield.
e. TRANSFORMERS, CHOKES, CAPACITORS. Transformers, chokes, and capacitors must be free of scratches, chipped edges, and bent surfaces.

6-13. REAR PANEL INSIDE INSPECTION. Use the following list when inspecting the back of the rear panel. Check each item fully before proceeding with the next item.
a. HARDWARE. All mounting hardware must be brass nickel plated, tightly fastened, and free of burrs.
b. SCREENING. Screening of reference symbols must be clear and legible.
c. CONNECTORS. Connectors J501, J502, and J503 must be tightly fastened to panel with proper hardware. Bakelite surface of J501 and J502 must show no signs of cracks or chipped edges.
d. TERMINAL BOARDS. Terminal boards must be free of chipped edges. Check for broken or bent terminals.
e. SOLDERING. Soldered joints must be clean and neat. There must be no cold solder or rosin on joints. Check for sharp edges and rough surfaces.
f. LEAD DRESSING. Leads must be neatly dressed in a manner which will eliminate any possibility of arcing due to proximity to components at different potentials.

6-14. DUST COVER INSPECTION. Inspect the dust cover by making the following checks.
a. FINISH. Check for scratches, distortion, or damage to case. Grounding braid on inside of cover must be securely mounted in place.
b. HARDWARE. Check for four corner gussets and captive screws.

6-15. TRANSMITTER MECHANICAL INSPECTION.

6-16. FRONT PANEL INSPECTION. Use the following list when inspecting the outside of the front panel. Check each item fully before proceeding with the next item.
a. NAMEPLATE. Nameplate must show no sign of looseness and must be mounted with lock washers to front panel.
b. PAINT FINISH. Paint finish must be clean. Must show no signs of scratches, chipped edges, or defacement by foreign matter.
c. HANDLES. The two handles mounted on front panel must be straight and securely mounted to front panel.
d. HARDWARE. Mounting hardware on front panel must be painted with the exception of mounting screws on access panels, which are brass nickel plated. All hardware must be tightly fastened and free of burrs.
e. METERS. Meters must be securely mounted to front panel. Pointers must not be bent or rub on glass or face of meter. Glass should show no signs of cracks, chips, or looseness.
f. FUSE HOLDERS. Fuse holders must be securely mounted to panel with no signs of chips or cracks. Blower fuse holder must contain 1-ampere fuse. Meter fuse holder must contain 1/100-ampere fuse (1/32-ampere in T-282B/GR units).
g. DIAL FINISH (TOTAL OF 9). Dial faces, engraving, and concentricity should be checked. There must be no evidence of scratches or bent and sharp edges on dials. Knobs must be tight and free of chipped edges.
h. KNOB ALIGNMENT. Knobs must rotate easily with no evidence of binding. Knob pointers must align with the screened limits of calibration at maximum clockwise and counterclockwise rotation.
i. DIAL LOCKS (TOTAL OF 9). Dial locks must lock dials securely. Must be securely mounted. Under-side of dial plate should clear the shoulder on lock post by not more than 1/64 inch.
j. KNOB SET-SCREWS. Control knobs must be checked with wrench for tightness. (2 per knob.)
k. CRYSTAL OVEN COVER. Cover must be tightly screwed in place. Must be securely chained to front panel. There should be no signs of bent or scratched areas on cover.
l. MONITOR AND SCREEN MODULATOR ASSEMBLY. Must be securely mounted to front panel by six unpainted mounting screws. Check for nicked edges. Handle must be securely mounted to panel.
m. TEST POINT AND RELAY COVERS. Must be securely fastened to front panel. Chain from each panel to front panel must be tightly fastened at each end.
n. TOGGLE SWITCH. Toggle switch must be tightly mounted. Switch must snap into place at each designated position.
o. AIR FILTER ASSEMBLY. Air filter assembly must be securely mounted to front panel by six captive screws. Filter screen must show no signs of broken or bent areas.

6-17. RIGHT SIDE SECTION INSPECTION. Use the following list when inspecting the right side of the transmitter. Check each item fully before proceeding with the next one.
a. HARDWARE. Mounting hardware must be tightly fastened and free of burrs. Must be brass nickel plated. Check for flat and lock washers in proper places.
b. SET SCREW TIGHTNESS. Set-screws in all collars, shafts, and gears must be checked with wrench for tightness. Check for glyptal on set-screws.
c. GEAR ASSEMBLIES. Gears must be tightly fastened in proper position. Must mesh properly and show no signs of binding. Check for proper assembly hardware and presence of burred teeth on gear assemblies.
d. INTERLOCK SWITCH S901. Switch must be securely mounted to inside of rear panel. Check the two soldered connections and insulator between switch and mounting bracket.
e. POTENTIOMETERS IN MONITOR SCREEN MODULATOR ASSEMBLY. Potentiometers must be tightly fastened in place with proper mounting hardware.

Mounting bracket on which potentiometers are mounted must be securely fastened to monitor chassis.

f. TUBE SHIELDS (TOTAL OF 6). Each tube should be covered with a properly seated tube shield.

g. SCREENING. All markings must be clear and legible.

h. SOLDERING. Soldered joints must be neat, clean, and free of excess rosin or solder. There should be no evidence of sharp points or rough surfaces.

i. LEAD DRESSING. Leads must be dressed in a manner which will eliminate any possibility of arcing due to proximity to components at different potentials.

j. CABLES. All wires must be neatly and tightly bound into cable form. There must be sufficient slack to prevent stress on individual wires or terminals. Check for clamps in proper places.

6-18. REAR PANEL INSPECTION. Use the following check-off list when inspecting the rear panel. Check each item fully before proceeding with the next one.

a. PAINT FINISH. Panel face and edges should be clean, should show no signs of chipping. The four edges of the rear panel must be absolutely clean and free of paint for a distance of 1/4-inch around edges.

b. SCREENING. All markings must be clear and legible.

c. HARDWARE. Mounting hardware on rear panel should be painted with the exception of twelve nickel plated captive screws which mount the air filter assembly to rear panel. All hardware must be tightly fastened and free of burrs. Check for lock washers in proper places.

d. FUSE HOLDERS. Fuse holders must be tightly fastened to panel. Must show no signs of chipped edges or cracks. Each fuse holder should contain 1/16-ampere fuse.

e. CONNECTORS. Connectors J913, J914, and J915 should be securely mounted in proper position. There must be no stripped or cross threads on connectors. Pins of connectors must be straight and securely set in place. Check for chipped edges and cracks on bakelite.

f. AIR FILTER ASSEMBLY. Filter screen must show no signs of broken or bent areas.

g. TERMINAL BOARD (MUTER TERMINALS). Terminal board must be securely mounted to rear panel. Must be free of cracks or chipped edges. Check for proper mounting hardware.

h. SCREW INSERTS. Check screw inserts, one in each of the four corners of rear panel. Threads must be clean with no evidence of stripping.

6-19. LEFT SIDE SECTION INSPECTION. Use the following list when inspecting the left side of the transmitter. Check each item fully before proceeding with the next one.

a. HARDWARE. Hardware must be brass nickel plated, tightly fastened, and free of burrs. Check for flat and lock washers in proper places.

b. SET-SCREWS. Set-screws in shafts, collars, and gears must be checked for tightness with a wrench. Check for glyptal on set screws.

c. GEAR ASSEMBLIES. Gears must be securely mounted in proper position with proper hardware. Check for improper mesh and signs of burrs or presence of foreign matter on gears.

d. CABLES. All wires must be neatly and tightly bound into cable form. There must be sufficient slack in cable to prevent stress on individual wires or terminals. Check for clamps in proper places. Cable assembly W905 must be tightly fastened to right angle connectors at each end; cable assembly must not be nicked, cut, or show signs of cracking.

e. BLOWER GASKET. Rubber gasket on blower assembly must be properly seated, free of tears, pinch marks, and holes.

f. SWITCH S602. Switch must be securely mounted. Check for cracks and chipped edges on bakelite surface. Lugs must not be bent or broken.

6-20. TOP OF SECTION INSPECTION. Use the following check-off list when inspecting the top of the transmitter. Check each item fully before proceeding with the next one.

a. HARDWARE. Hardware must be brass nickel plated, tightly fastened, and free of burrs. Check for lock and flat washers in proper places.

b. REAR OF "METER 1." Meter must show no damage to housing and terminals. Check for excess solder and rosin. Insulation must not be frayed or burnt.

c. CAPACITORS C802 AND C803. Capacitors must be securely mounted over "METER 1." Must show no signs of bent or scratched areas on surface. Check for neat wiring and possible damage to terminals.

d. TRANSFORMER (BLACK CASE). Painted surface of transformer must show no signs of scratched or bent areas. Must be securely and properly mounted. Cable clamps must hold cable securely in place. Check for broken terminals, poor wiring and soldering.

e. DRIVE CHAIN. After chain has been properly adjusted, all adjusting screws must be securely fastened in place. Pins placed in collars and gears must be securely fastened in proper places. Check for signs of broken links or foreign matter which will hamper proper operation of chain on gears.

6-21. BOTTOM SECTION INSPECTION. Use the following check-off list when inspecting the bottom of the transmitter. Check each item fully before proceeding with the next one.

a. HARDWARE. Hardware must be brass nickel plated and proper size. Must be tightly fastened and show no signs of burrs. Check for flat and lock washers in proper places.

b. TERMINAL BOARDS. Terminal boards E901, E902, and E903 must be securely mounted in place, each with four mounting screws. Check for flat and lock washers in proper places. Terminal boards must show no sign of burred screws, broken terminals, chipped edges or cracks on surface. Fanning strips E801, E802, and E803 must be securely mounted to their respective terminal boards with all screws tightened securely.

c. CABLES. All wires must be neatly and tightly bound into cable form. There must be sufficient slack in cables to prevent stress on cable form and terminals. Check for required cable clamps in proper places.

d. ANTENNA RELAY O-901. Relay must be securely fastened to mounting bracket. Surface should show no signs of cracks or chipped edges. Exterior of coil must show no signs of damage to cloth covering, bakelite insulators, or terminals. Cable assemblies W906 and W907 must be securely fastened to relay.

e. FILTER Z901. Filter must be securely connected to relay O-901 at one end, other end tightly connected to directional coupler DC901. Filter must show no signs of damage such as bent areas, scratches, or defacement by foreign matter.

f. FUSE HOLDERS. Fuse holders must be tightly fastened to rear panel. Check for cracks, chipped edges, and broken terminals.

g. REAR PANEL CONNECTORS. All connectors must be securely fastened in place. Bakelite mountings must be free of cracks, chipped edges, and excessive looseness. Inspect for bent pins and proper insulation.

h. CAPACITORS (6). Capacitors C902, C905, C910, C912, and C916 must be securely fastened to cover plates. Check for broken terminals on capacitors. With the exception of C905 and C916, color coding of capacitors should indicate 1,000 uuf. C905 and C916 are 100 uuf each.

i. CAPACITORS (4). Capacitors C919 and C920 located on rear panel, and capacitors C706 and C707 located on rear of front panel of monitor-screen modulator must be securely fastened to the panels. They must be mounted on surfaces which are clean and free of paint. Bare metal must be visible around the base of these capacitors. There must be a lock washer between each capacitor and its mounting surface.

j. TEST JACK ASSEMBLY. Assembly must be securely fastened to mounting plate. Check for proper mounting hardware. There must be no signs of broken terminals, cracks, or chipped edges.

k. RESISTOR BOARDS. Two resistor mounting boards must be securely mounted to rear of test jack plate. Mounting boards E707 and E708 are mounted to rear of front panel on monitor-screen modulator. There must be no signs of cracks or chipped edges on bakelite surfaces. All components should be securely wired and soldered in proper places. Check for broken or bent terminals.

l. RELAY SOCKET ASSEMBLY. Socket X801 (for push to talk relay) must be securely fastened to mounting bracket. Socket must be free of cracked or chipped areas. Inspect wiring for broken leads, poor soldering, and broken or bent pins.

m. SOLDERING. Soldered joints must be neatly dressed in a manner which will eliminate any possibility of arcing due to proximity of components of different potentials. There must be no signs of split or burnt insulation.

n. SCREENING. Screening (of symbol numbers and other markings) must be clear and legible.

o. CABLE CONNECTIONS. Check following connections:

J907 of cable assembly W901 connected to J908 on directional coupler DC901.

P905 on DC901 connected to J906 on r-f filter Z901.

One end of cable assembly W906 connected to "ANT INPUT" jack J907 on rear panel. P903 at other end of W906 connected to J905 (receive side) of antenna relay O-901.

P902 of cable assembly W907 connected to J903 (transmit side) of O-901. The other end of W907 connected to right angle fitting E908 on right side of transmitter.

P908 on one end of cable assembly W905 connected to J916 (driver output). P901, on other end of cable, connected to J902 (power amplifier input).

P904 on Z901 connected to J904 (armature) of O-901.

6-22. DUST COVER INSPECTION. Inspect the dust cover by making the following checks.

a. FINISH. Check for scratches, distortion or damage to case. Grounding braid on inside of cover must be securely mounted in place.

b. HARDWARE. Check for four corner gussets and captive screws.

SECTION VII

REPAIR AND REPLACEMENT

7-1. GENERAL.

7-2. When a component part is found to be defective, it should be replaced, except tuning stubs and other plated items which may be economically refinished in accordance with the manufacturer's drawing for the defective part.

7-3. TRANSMITTER TUNING MECHANISM. The tuning mechanism will normally not require any repairs and/or replacement of parts during the life of the equipment. In the event that the tuning system should fail to function properly, due to broken gears or their tuning mechanism linkages, disassemble the affected section (see Section IV) and replace the damaged parts.

7-4. REPLACEMENT OF BLOWER MOTOR BEARINGS. Noisy blower motor operation indicates that the bearings must be replaced. The bearings on blower motors B401 and B801 may be replaced as follows:

a. Remove motor from equipment. See Section V of the applicable Handbook of Service Instructions.

b. Remove one end plate from motor and pull out the armature; remove the bearings with a standard bearing puller. If a bearing puller is not available,

use the method described in the steps that follow.

c. Slip motor shaft, between armature and shaft bearing, into slit of a block of wood or metal block. If metal block is used, place a rubber washer between the block and the bearing.

d. Place block of wood on top of the motor shaft. Strike the block of wood, gently, with a hammer, and drive the shaft out of the bearing. Take necessary precautions to keep the armature from falling to the floor.

e. Place a block of wood atop the new bearing and hammer it on to the armature shaft; the wooden block will cushion the hammer blows so as not to damage the bearing. Continue hammering, gently, until the shaft just touches the wooden block.

f. Place a piece of metal tubing, having a minimum inside diameter of 5/16-inches and a maximum outside diameter of 9/16-inches, over the inner sleeving of the bearing.

g. Tap gently on the tubing until the bearing is driven into place.

h. This completes replacement of the motor shaft bearing.

7-5. RETROPICALIZATION OF MODULATOR-POWER SUPPLY AFTER REPAIRS.

7-6. All parts of the modulator-power supply requiring the application of a fungicide, initially received moisture and fungus-proof treatment, prior to or after final assembly. After replacement, resoldering, or rewiring of any component, treat the soldered connections with TUF-ON 74F MFP Varnish, or equivalent, by cleaning and drying the connections and then brushing on the MFP varnish with a clean brush. Allow sufficient drying time to remove any "tackiness."

7-7. RETROPICALIZATION OF TRANSMITTER AFTER REPAIRS.

7-8. None of the exposed current carrying parts within the r-f section of the transmitter require moisture and fungus-proofing. Similarly, all gears and mechanical linkages in the tuning mechanism should remain without a fungicide. All other parts, cables, wires, and solder connections should be treated with TUF-ON 74F MFP Varnish or equivalent, after rewiring or repairing the unit.

SECTION VIII

REASSEMBLY AND TESTING OF SUBASSEMBLIES AND ASSEMBLIES

8-1. REMOVAL AND REASSEMBLY OF AUDIO DRIVER SUBASSEMBLY. Removal of the audio driver subassembly is described in Section V of the applicable Handbook of Service Instructions for this equipment. Reassembly is accomplished by reversing the steps necessary for the disassembly.

8-2. TESTING AUDIO DRIVER SUBASSEMBLY.

8-3. The audio driver subassembly (see figure 8-1) is tested for correct operation within the modulator chassis of the modulator-power supply unit, because of the load conditions that must prevail for the output circuits of the subassembly, in order to give correct indications. However, if the audio driver subassembly has been removed, it is pre-tested before being reassembled. Proceed with the testing procedure as follows:

a. Check the filament circuit with all tubes removed from the chassis. Use a Triplett Model 630-A multimeter, or equal, with the range selector set to the highest resistance range. Ground one test lead to the audio driver chassis and touch the other lead to terminal 14 of multi-contact female connector J308. The meter should read infinite resistance.

b. Repeat step a. but touch terminal 15 of J308. The meter should give an indication of infinite resistance.

c. Insert six tubes, V301 through V306, into their respective sockets.

d. Check again for possible short and open-circuits, using a meter as in steps a and b. Connect one lead to the chassis and the other lead to terminal 1 of J308. The meter should give an indication of zero ohms.

e. Repeat step d but touch terminals 2, 3, and 5 of J308, in turn. The reading in each case shall be infinite resistance.

f. Repeat step d but touch terminal 6 of J308. The resistance indicated should be approximately 24,000 ohms with the "LIMITER THRESHOLD" control at the extreme clockwise position; a reading of approximately 29,000 ohms should be indicated when the control is at the extreme counterclockwise position.

g. Repeat step d but touch terminal 7 of J308. The resistance indicated should be zero ohms when "PUSH TO TALK-CARRIER ON" switch is set to "CARRIER ON" position; a reading of infinite resistance should be indicated when the switch is on the "PUSH TO TALK" position.

h. Repeat step d but touch terminal 9 of J308. The meter should indicate a resistance of 20,000 ohms.

i. Repeat step d but touch terminals 10 and 12 of J308, in turn. The resistance in each case should be 81 ohms. This concludes the preliminary checking of the audio driver subassembly.

8-4. The following steps require the unit to be mounted in the modulator-power supply so that all operating voltages and output load circuits are functioning:

a. Reassemble the audio driver subassembly. Reverse the steps in Section V of the applicable Handbook of Service Instructions for this equipment.

b. Connect the modulator-power supply to a suitable load; use the test unit described in Section II, or use the radio transmitter tuned up and with

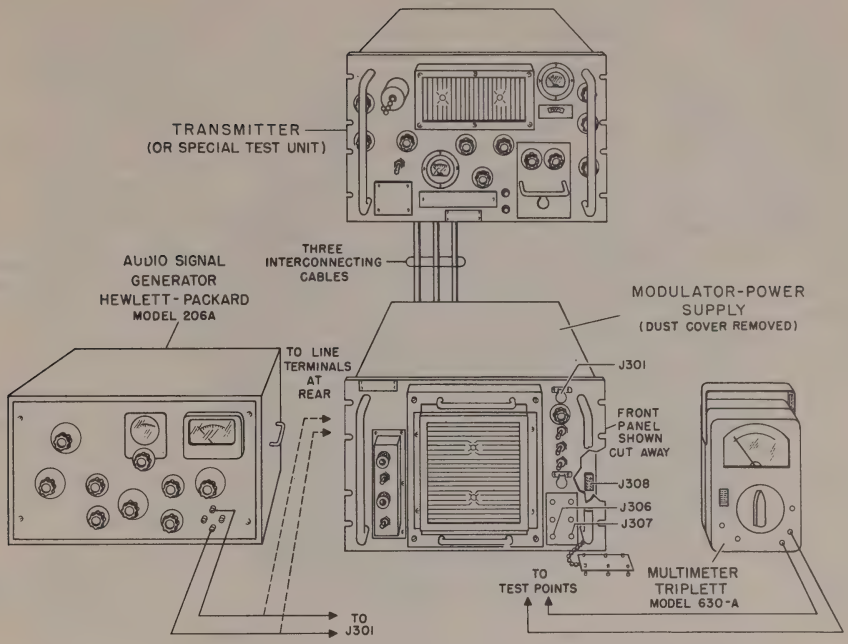


Figure 8-1. Modulator-Power Supply, Set-Up for Testing Audio Driver Subassembly

a dummy load connected to the antenna connector.

c. Set "NORMAL-EMER" switch S301 to the "NORMAL" position.

d. Set "PUSH TO TALK-CARRIER ON" switch S302 to the "PUSH TO TALK" position.

e. Set "NARROW-BROAD" switch S303 to the "BROAD" position.

f. Turn "POWER" switch S403 (front of modulator-power supply) to the "ON" position.

g. Observe that the tube filaments on the audio driver subassembly chassis all begin to glow.

h. Connect "OUTPUT" terminals of Hewlett-Packard Model 206A Audio Signal Generator to "MIKE" jack J301; use 3-circuit phone plug. Connect jumper between "CT" and "G" terminals. Set controls on audio signal generator as follows:

i. Tune "FREQUENCY" control for a reading of "100" on dial.

j. Set "RANGE" switch to "X10." The generator is now tuned to 1,000 cps.

k. Set attenuator controls for 60 db.

l. Adjust "AMPLITUDE" control for plus 15 dbm (decibels below one milliwatt) on meter. Output level is now 45 db (decibels) below one mw (milliwatt).

m. Set "IMPEDANCE" switch to "50."

n. Set "GAIN" control R306 to the extreme counterclockwise position.

o. Set "LIMITER THRESHOLD" control R335 to the extreme clockwise position.

p. Set the range selector switch on a Triplett Model 630-A multimeter to 3 V AC. Ground the lead from the "COM" jack and connect the lead from the "OUTPUT" jack to test jack J306 on the front of the audio driver.

q. Set "PLATE" switch S401 (front of modulator-power supply) to the "ON" position. The red "PLATE" indicator will light (if one minute has elapsed since the "POWER" switch was turned "ON").

r. Slowly turn "GAIN" control in clockwise direction until multimeter reads 2.0 volts on bottom red scale. This checks amplifier operation on "MIKE" input.

s. Set "NORMAL-EMER" switch S301 to the "EMER" position. The multimeter should still read 2.0 volts. This checks the wiring of switch S301. Return switch to "NORMAL" position.

t. Set "PUSH TO TALK-CARRIER ON" switch S302 to the "CARRIER ON" position. Remove phone plug from "MIKE" jack. Proper operation is indicated by zero reading on the multimeter while the red "PLATE" indicator remains lit.

u. Reinsert phone plug in "MIKE" jack. Set "LIMITER THRESHOLD" control to extreme counterclockwise position. Multimeter should read at least 7.0 volts (multimeter range selector on 12 V AC). This checks the automatic modulation limiter circuit.

v. Disconnect the multimeter test lead to J306 and reset the range selector switch to 300 V DC. Connect the test lead from "V-Ω-A" jack to test jack J307 on the front of the audio driver.

w. Vary the "LIMITER THRESHOLD" control between the extreme clockwise and counterclockwise positions. The multimeter readings should vary between 90 volts and 155 volts. This checks the automatic modulation limiter control. Reset control

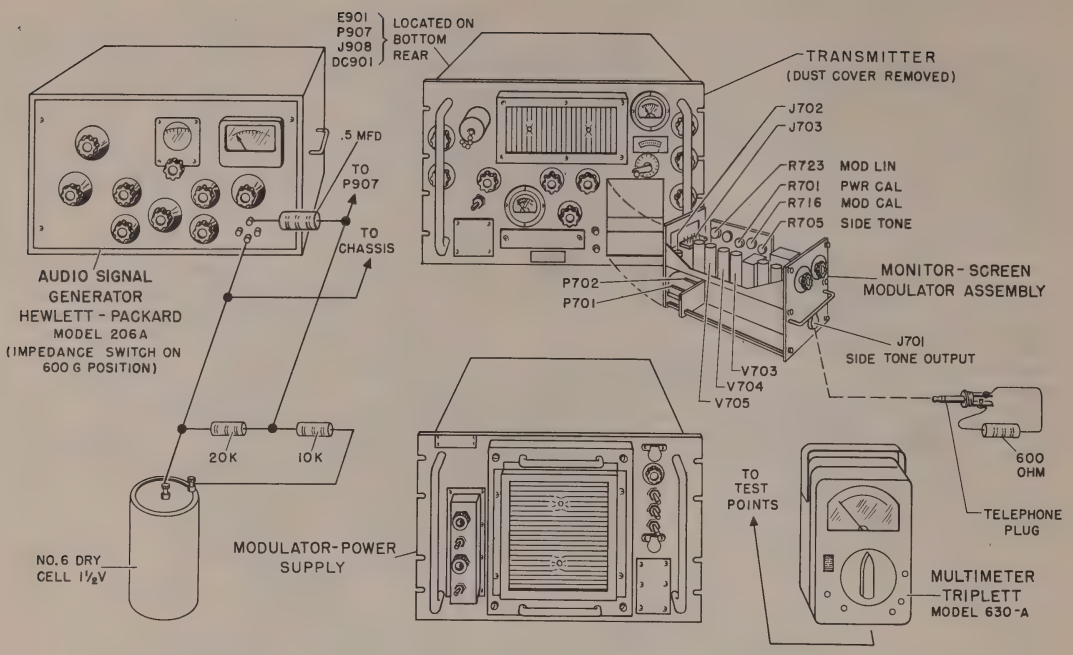


Figure 8-2. Transmitter, Set-Up for Testing Monitor-Screen Modulator Assembly

to the extreme clockwise position.

x. Disconnect audio signal generator from "MIKE" jack and reconnect to "LINE" terminals at rear of modulator-power supply; set generator impedance switch to "600."

y. Adjust "GAIN" control for reading of 2.0 volts on multimeter connected between J306 and ground as in step k. This checks operation of audio driver on line input.

z. Set audio signal generator to 10,000 cps (cycles per second) and adjust for an output level of 45 db below 1 mw. Set "NARROW-BROAD" switch S303 to the "NARROW" position. The reading on the multimeter should drop to a value of not more than 1.33 volts. This checks the operation of the narrow band amplifier stage (V301) and its associated band pass filter. Reset switch to "BROAD" position. This concludes testing of the audio driver sub-assembly.

8-5. REMOVAL AND REASSEMBLY OF MONITOR-SCREEN MODULATOR ASSEMBLY. Removal of the monitor-screen modulator assembly is described in Section V of the applicable Handbook of Service Instructions. Reassembly is accomplished by reversing the steps necessary for the disassembly.

8-6. TESTING MONITOR-SCREEN MODULATOR ASSEMBLY.

8-7. The monitor-screen modulator assembly (see figure 8-2) is tested for correct operation within the transmitter because of the load conditions that must prevail for the input and output circuits in order to give correct indications. The assembly is pre-tested before being reassembled. Proceed with the testing as follows:

a. Check the filament circuits with V701, V702, and V706 removed from the chassis. Use a Triplett Model 630-A multimeter, or equal, with the range selector set to the highest resistance range. Ground one test lead to the monitor-screen modulator chassis and touch the other lead to terminal 5 and then to terminal 6 of multi-contact male connector J703. In both cases the meter should read infinite resistance.

b. Repeat step a but touch terminal 4 of J703. The meter should give an indication of 75,000 ohms. This checks the other side of the filament circuit of V706, as well as its cathode circuit.

c. Repeat step a but touch terminal 1 of J703. The meter should indicate zero resistance. This checks the ground connection to the connector plug.

d. Repeat step a but touch terminal 3 of J703. The meter should read 150,000 ohms when "METER 2 SELECTOR SWITCH" is set to the "% MOD" position. This checks the cathode circuit of V701B.

e. Repeat step a but touch terminal 7 of J703. The meter should indicate 100,000 ohms. This checks the plus 250-volt input circuit to the assembly.

f. Repeat step a but touch male connector P701 at the rear of the assembly. The meter should read infinite resistance. This checks the high voltage unmodulated input circuit of the assembly.

g. Repeat step a but touch male connector P702 at the rear of the assembly. The meter should give an indication of 760,000 ohms. This checks

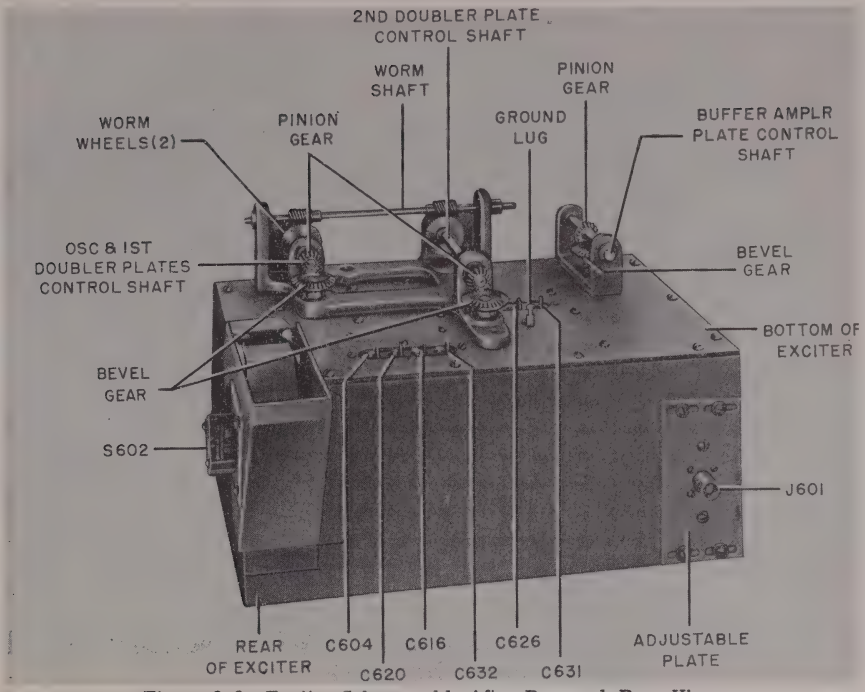


Figure 8-3. Exciter Subassembly After Removal, Rear View

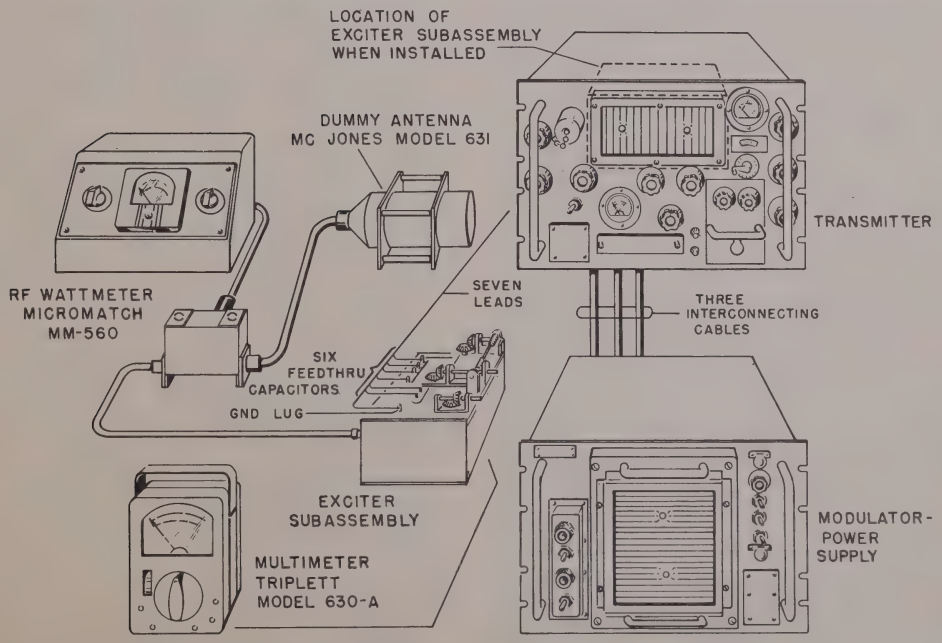


Figure 8-4. Set-Up for Testing Exciter Subassembly

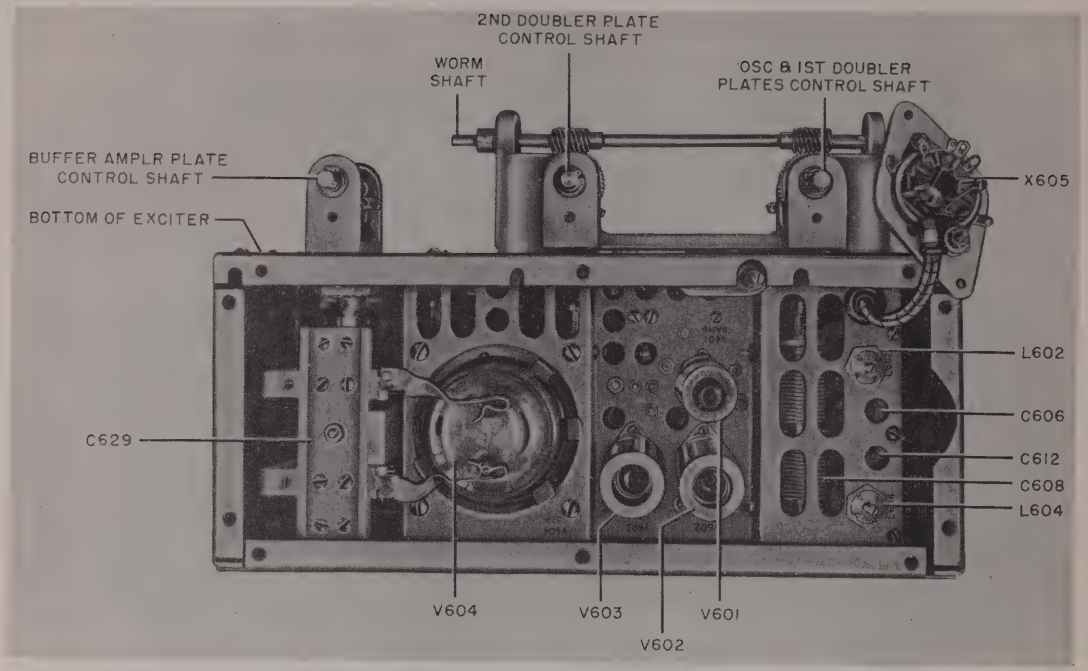


Figure 8-5. Exciter Subassembly After Removal, Front View

the high voltage modulated input circuit of the assembly. This concludes the preliminary checking of the monitor-screen modulator assembly.

8-8. The following steps require the monitor-screen modulator assembly to be mounted in the transmitter so that all operating voltages as well as input and output load circuits are functioning:

a. Reassemble the monitor-screen modulator assembly. Reverse the steps in Section V of the applicable Handbook of Service Instructions for this equipment.

b. Disconnect male connector P907 from J908 of directional coupler DC901.

c. Superimpose 0.7-volt ac (from audio signal generator set to 1,000 cps) on 1.0-volt dc, and insert into P907. Use Triplett 630-A multimeter, or equal, for a-c and d-c voltage measurements. Refer to details, shown on figure 8-2, for d-c voltage divider and audio input connections.

d. Throw "POWER" and "PLATE" switches (front of modulator-power supply) to "ON" position. Set "PUSH TO TALK-CARRIER ON" switch to "CARRIER-ON" position. "POWER" indicator (green) will light immediately; "PLATE" indicator (red) will light after approximately one minute time delay.

e. Check to see that voltage regulator tubes (V703, V704, V705) are on, i.e., emitting a bluish glow (after one minute time delay).

f. Set "METER 2 SELECTOR SWITCH", on front of monitor-screen modulator assembly, to "CARRIER WATTS" position. Adjust "PWR CAL" control R701, on right side of assembly (transmitter dust cover off), for reading of approximately 100 watts on "METER 2."

g. Connect multimeter (3 V AC range) and 600 ohm resistor (or 600 ohm headset) to 2-circuit phone plug, and insert in "SIDE TONE OUTPUT" jack J701. Adjust "SIDE TONE" control R705, on right side of assembly, until multimeter reads approximately 0 db.

h. Set "METER 2 SELECTOR SWITCH" to the "SET CAL" position. Adjust the front panel "CALIBRATE" control until "METER 2" reaches the "CAL" mark.

i. Set "METER 2 SELECTOR SWITCH" to the "% MOD" position. Adjust "MOD CAL" control R716, on right side of assembly, for a reading of approximately 95 percent modulation on "METER 2."

j. Disconnect multimeter from "SIDE TONE OUTPUT" jack. Set selector switch to 300 V AC range. Ground lead from "COM" jack and touch the other lead from the "OUTPUT" jack to terminal 12 of terminal board E901, bottom, rear section of transmitter. Adjust "MOD LIN" control R723, on right side of assembly, so that multimeter reads between 0 and -6 db. This checks the cathode follower action of screen modulator tube V706.

k. Turn "POWER" and "PLATE" switches to "OFF" position, and then remove test equipment. This concludes testing of the monitor-screen modulator assembly.

8-9. REMOVAL AND REASSEMBLY OF EXCITER SUBASSEMBLY. Removal of the exciter subassembly is described in Section V of the applicable Handbook of Service Instructions for this equipment. Re-

assembly is accomplished by reversing the steps necessary for the disassembly.

8-10. TESTING EXCITER SUBASSEMBLY

8-11. The exciter subassembly (see figures 8-3, 8-4 and 8-5) is tested for correct operation while removed from the transmitter. It must first be pre-tested. Jumpers are then used to connect the subassembly to its six plate, grid and filament supply leads. Remove the subassembly and proceed with the testing procedure as follows:

a. Check the filament circuit with all tubes and the crystal oven removed from the chassis. Use a Triplett Model 630-A multimeter, or equal, with the range selector set to the highest resistance range. Ground one test lead to the exciter chassis and touch the other lead to the tab of feed-through capacitor C620. The meter should read infinite resistance.

b. Insert four tubes, V601 through V604, into their respective sockets. Insert crystal oven A601 (crystal unit Y601 inside oven).

c. Repeat step a but touch the tab of feed-through capacitors C604, C616, C632, C626, and C631, in turn. The reading in each case shall be infinite resistance. This checks the following circuits. V601 grid return, V603 grid return, plus 250-volt supply, V604 grid return, and plus 300-volt supply. This concludes the preliminary checking of the exciter subassembly.

8-12. The following steps require the subassembly to be connected, with jumpers, to the rest of the transmitter (after disengaging drive mechanisms) so that all operating voltages as well as output load circuits are functioning:

a. Set subassembly upside down on workbench. Gears and feed-through capacitors will then be accessible.

b. Drive out roll pins (with punch and hammer) that lock pinion to bevel gear of the "OSC & 1ST DOUBLER PLATES" and "2ND DOUBLER PLATE" control shafts. (See figure 8-3.)

c. Pull pinion gears forward so as to disengage from bevel gears. Tuning capacitors C608 may now be tuned independently by turning their respective bevel gears.

d. Loosen four screws in plate at rear of subassembly (J601 is in center of plate). (See figure 8-3.)

e. Connect jumpers: between wires previously unsoldered (during disassembly), and the six feed-through capacitors; between the exciter chassis and a convenient ground point on the transmitter; across air interlock switch S602; and between wires from interlock switch S601.

f. Connect directional coupler (with its associated power output indicator) and a 50-ohm dummy antenna to J601. Use a Micromatch MM-560, or equal, power output indicator, that can readily indicate power levels of up to 12 watts. (See figure 8-4.)

g. Replace crystal Y601 with special 6.06-mc test crystal (for final transmitter output frequency of 218 mc).

h. Disconnect lead from terminal 9 of fanning strip E802, bottom, rear section of transmitter.

i. Set selector switch on Triplett Multimeter Model 630-A to 120 DCMA; connect between disconnected lead and terminal 9 of E802. This permits measurement of the plate and screen current (plus 250 volts) of the first three stages of the exciter.

j. Set "TUNE-OPERATE" switch, front of transmitter, to "TUNE" position.

k. Set "PUSH TO TALK-CARRIER ON" switch, front of transmitter, to "CARRIER ON" position.

l. Turn "POWER" and "PLATE" switches, front of modulator-power supply to "ON" position. "POWER" indicator will light immediately; "PLATE" indicator will light after time delay of approximately one minute.

m. Turn "OSC & 1ST DOUBLER PLATES" tuning capacitor C608 to maximum capacitance (plates fully meshed).

n. Tune L602 (see figure 8-5) for dip in multimeter reading. This adjustment is required for low frequency tracking of the oscillator-tripler stage (V601).

o. Tune L604 for maximum reading on "METER 1," "METER 1 SELECTOR SWITCH" of transmitter on "2." This adjustment is required for low frequency tracking of the first doubler stage (V602).

p. Retune L602 for maximum reading on "METER 1."

q. Remove special 6.06-mc test crystal and replace with special 11.39-mc test crystal (for final transmitter output frequency of 410 mc).

r. Tune C608 to minimum capacitance (plates open all the way).

s. Tune trimmer C606 (accessible through hole directly under L602) for dip in multimeter reading. This adjustment is required for high frequency tracking of the oscillator-tripler stage.

t. Tune trimmer C612 (accessible through hole directly above L604) for maximum reading on "METER 1." This adjustment is required for high frequency tracking of the first doubler stage.

u. Retune C606 for maximum reading on "METER 1."

v. Repeat steps m through u until retuning of coils and trimmers cause no further increase in readings on "METER 1."

w. Remove special 11.39-mc test crystal and replace with 7.0-mc crystal (for final transmitter output frequency of 252 mc).

x. Tune C608 for dip in multimeter reading (capacitor plates should be approximately half meshed).

y. Tune "2ND DOUBLER PLATE" tuning capacitor C621 for maximum reading on "METER 1," "METER 1 SELECTOR SWITCH" on "3." This adjustment is required to get C621 to track with C608.

z. Tune "BUFFER AMPLR PLATE" tuning capacitor C629 for maximum power output indication on power output indicator.

aa. Retune C608, C621, and C629 for maximum power output indication on power output indicator (approximately 4.5 watts).

ab. Turn worm shaft until the two stop pins, in each of the two worm wheels, are lined up horizontally. (See figure 8-3.)

ac. Turn first two control shafts until stop collar pins (one on each collar) are exactly centered between worm wheel stop pins.

ad. Carefully mesh pinion and bevel gears so as not to disturb setting of C608 and C621. Temporarily secure pinions to shafts with No. 6 set-screws (one in each); set-screw holes have been provided.

This will keep the pinions in place until the roll pins are replaced.

ae. Remove 7.0-mc crystal and replace with 6.25-mc crystal (for final transmitter output frequency of 225 mc).

af. Turn the worm shaft for dip in multimeter reading.

ag. Tune "2ND DOUBLER PLATE" control shaft; must get maximum reading on "METER 1," with "METER 1 SELECTOR SWITCH" on "3," when stop collar pin falls between worm wheel pins; if not, repeat steps ab through af.

ah. Tune "BUFFER AMPLR PLATE" tuning capacitor C629 for maximum power output indication on power output indicator (at least 4.5 watts).

ai. Remove 6.25-mc crystal and replace with special 11.11-mc test crystal (for final transmitter output frequency of 400 mc).

aj. Turn the worm shaft for dip in multimeter reading (tuning capacitor plates nearly all the way out). Disregard the dip which occurs at an intermediate setting of the capacitor, due to resonance at an undesired harmonic of the crystal frequency.

ak. Tune "2ND DOUBLER PLATE" tuning capacitor C621 for maximum reading on "METER 1."

al. Tune "BUFFER AMPLR PLATE" control shaft for maximum power output indication on power output indicator.

am. Adjust (slide) plate, rear of exciter, for maximum power output indication.

an. Alternately tune "BUFFER AMPLR PLATE" control shaft and adjust rear plate until maximum power output indication is obtained.

ao. When the maximum exciter power output is secured (at least 6 watts), carefully tighten the four screws in the rear plate.

ap. Turn "PLATE" and "POWER" switches, front of modulator-power supply, to "OFF" position.

aq. Disconnect jumpers (see step e), disconnect multimeter and reconnect wire to terminal 9 of E802 (see steps h and i), and disconnect test equipment from J601 (see step f).

ar. Carefully drill hole through collar of pinions and on through their respective shafts. Use 1/16-inch dia drill. This may be disregarded if original holes in pinion collars and respective shafts are exactly in line. Drive a 1/16-inch dia roll pin into hole drilled through pinion collar and shaft (previously removed). Take out set-screws as they are no longer needed. This concludes testing and alignment of the exciter subassembly.

SECTION IX

REASSEMBLY AND TESTING OF COMPONENTS

9-1. FINAL ELECTRICAL TEST FOR MODULATOR-POWER SUPPLY UNIT.

9-2. Before the modulator-power supply can be given a final electrical test, check to see that the following conditions have been fulfilled:

a. All tests described in paragraphs 8-1 through 8-4 have been performed.

b. The unit is completely assembled, with audio driver subassembly in place and connected to the modulator and power supply chassis by reversing the steps for removal of the subassembly. Section V of the applicable Handbook of Service Instructions gives this information.

c. The unit is completely aligned as per Section VI of the applicable Handbook of Service Instructions.

9-3. EQUIPMENT RECOMMENDED. The following test equipment is recommended to perform the final electrical tests for the modulator-power supply (see figure 9-1):

a. Hewlett-Packard Model 330B Distortion Analyzer.
b. Hewlett-Packard Model 206A Audio Signal Generator.
c. DuMont No. 303 Cathode Ray Oscillograph.
d. T-17 Microphone.
e. Ballantine Model 300 A-C Vacuum Tube Voltmeter.
f. Ballantine Model 1300A Voltage Multiplier.
g. Superior Electric Powerstat Type 1226.
h. General Electric No. AP-9 A-C Voltmeter.
i. General Electric No. AP-9 A-C Ammeter.
j. General Electric No. AP-9 Wattmeter.
k. Special test unit. (See paragraphs 2-3 through 2-5.)

9-4. CONTROL SETTINGS. Set the following controls as indicated below:

a. Turn "POWER" switch S403 to "OFF."
b. Turn "PLATE" switch S401 to "OFF."
c. Turn "GAIN" control R306 to extreme counterclockwise position.
d. Turn "NARROW-BROAD" switch S303 to "BROAD" position.
e. Turn "EMER-NORMAL" switch S301 to "NORMAL" position.
f. Turn "PUSH TO TALK-CARRIER ON" switch S302 to "CARRIER ON" position.
g. Turn "LIMITER THRESHOLD" control R335 to extreme counterclockwise position.
h. Turn "BUCK-BOOST" switch S502 (rear panel) to "BOOST" position.
i. Make front door mounting screw finger-tight in order to check front access door interlock S402.
j. Make rear filter assembly mounting screws finger-tight so that it may be easily removed to expose fuses during test.
k. Set jumper O-202 (line voltage adjustment) to "115 VOLT" position.

9-5. TEST SET-UP. Connect test equipment to the modulator-power supply in the following manner:

a. Connect a power line to the "AC POWER INPUT" socket J504, located on the rear panel. This power line should be provided with a variac and meters to permit adjustments of the power line voltage. See figure 9-2 for the recommended set-up for line adjustment and power input measurement.

b. Connect three specially fabricated cables (see paragraphs 2-6 through 2-9) from rear of modulator-power supply to special test unit (see paragraph 2-5).

c. Connect "AF INPUT" terminals of Hewlett-Packard Distortion Analyzer Model 330B to "OSCILLOSCOPE" terminals of special test unit.

d. Connect "VERT" terminals of Dumont Oscilloscope No. 303 to "OSCILLOSCOPE" terminals of distortion analyzer.

e. Connect Ballantine Multiplier Model 1300A to input terminals of Ballantine Vacuum Tube Voltmeter Model 300. Set voltmeter range switch to "100 VOLTS FULL SCALE." Connect output terminals of multiplier to "HV MOD" jacks on front of special test unit.

f. Set "IMPEDANCE" control of Hewlett-Packard Audio Signal Generator Model 206A to "600;" connect jumper between "CT" and "G" of "OUTPUT" terminals; connect "OUTPUT" to "LINE" terminals on rear of modulator-power supply.

9-6. PRELIMINARY. In the following steps power will be applied to the modulator-power supply and voltages will be measured at important points. Turn the "POWER" switch to "ON." Normal indications are as follows:

a. Blower B401 will start operating.

b. The "POWER" indicator (green) will light.

c. "AC SUPPLY INPUT VOLTAGE" voltmeter, on the front of the special test unit, will swing upscale immediately.

d. The "AC SUPPLY INPUT CURRENT" ammeter, on the front of the special test unit, will swing upscale immediately.

e. The "BIAS SUPPLY VOLTS" voltmeter, on the front of the special test unit, will swing upscale approximately five seconds after turning the "POWER" switch to "ON."

f. The "BIAS SUPPLY CURRENT" ammeter, on the front of the special test unit, will swing upscale approximately five seconds after turning the "POWER" switch to "ON."

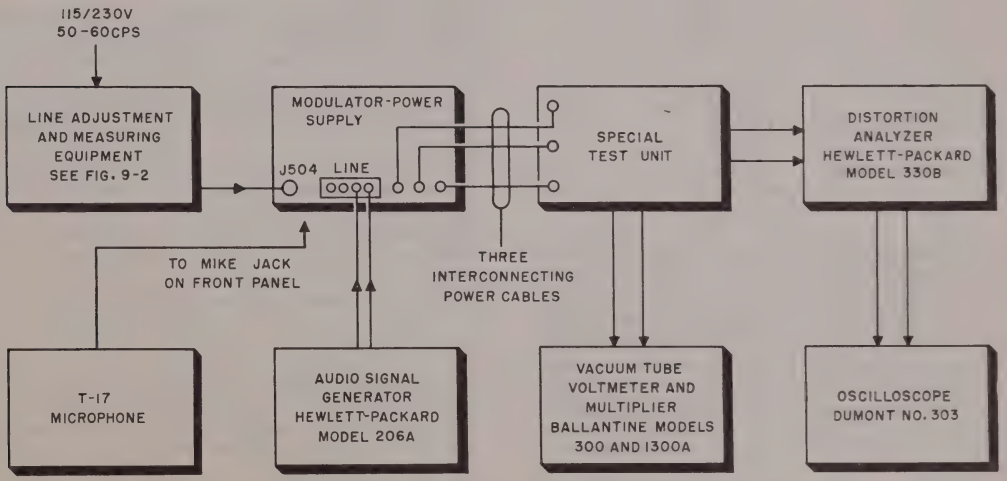

115/230V
50-60CPS
LINE ADJUSTMENT AND MEASURING EQUIPMENT SEE FIG. 9-2
MODULATOR-POWER SUPPLY
J504 LINE
SPECIAL TEST UNIT
DISTORTION ANALYZER HEWLETT-PACKARD MODEL 330B
TO MIKE JACK ON FRONT PANEL
THREE INTERCONNECTING POWER CABLES
T-17 MICROPHONE
AUDIO SIGNAL GENERATOR HEWLETT-PACKARD MODEL 206A
VACUUM TUBE VOLTMETER AND MULTIPLIER BALLANTINE MODELS 300 AND 1300A
OSCILLOSCOPE DUMONT NO. 303

Figure 9-1. Modulator-Power Supply, Set-Up for Final Electrical Test

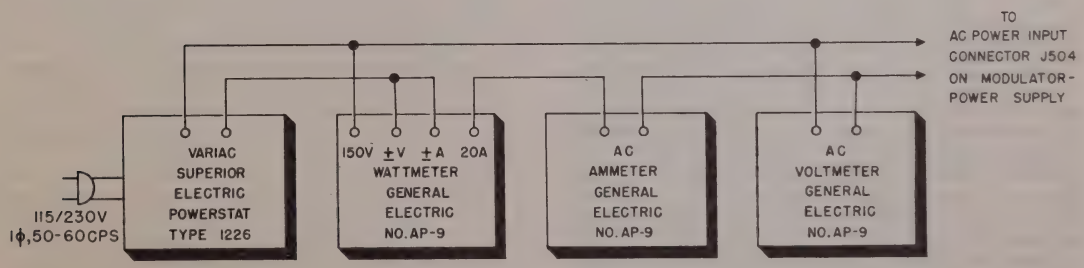

TO AC POWER INPUT CONNECTOR J504 ON MODULATOR-POWER SUPPLY
115/230V 1φ,50-60CPS
VARIAC SUPERIOR ELECTRIC POWERSTAT TYPE 1226
150V ±V ±A 20A WATTMETER GENERAL ELECTRIC NO. AP-9
AC AMMETER GENERAL ELECTRIC NO. AP-9
AC VOLTMETER GENERAL ELECTRIC NO. AP-9

Figure 9-2. Recommended Set-Up for Line Adjustment and Power Input Measurement

9-7. Turn the "PLATE" switch to "ON." Normal indications, approximately 60 seconds after turning the "POWER" switch to "ON," are as follows:

a. The "PLATE" indicator (red) will light.

b. All other voltmeters and ammeters (plus 250, plus 300, and plus 850 volt d-c supplies), on the front of the special test unit, will swing upscale.

c. Adjust variac and maintain line voltage at 115 volts throughout the tests that follow.

d. Turn "PUSH TO TALK-CARRIER ON" switch to "PUSH TO TALK" position. All plus 250, plus 300, and plus 850 voltmeters on the special test unit should drop back to zero.

e. Insert T-17 microphone into "MIKE" jack on front panel of modulator-power supply. Depress microphone button. All plus 250, plus 300, and plus 850 voltmeters should swing upscale.

f. Remove T-17 microphone from "MIKE" jack and reset "PUSH TO TALK-CARRIER ON" switch to "CARRIER ON" position.

g. Nominal meter readings are:

AC supply:	115 volts
	1.55 amp
Bias supply:	-100 volts
	58 ma
Plus 250 V supply:	+250 volts
	73 ma
Plus 300 V supply:	+300 volts
	65 ma
Plus 850 V supply:	+850 volts
	185 ma UNMOD
	270 ma PA

9-8. AUTOMATIC MODULATION LIMITER TEST. In the following steps an audio signal will be fed into the modulator-power supply. When properly adjusted, automatic modulation limiting should maintain the audio output voltage, from the modulator-power supply, at approximately the same level, when the audio input varies over a wide range of signal levels. Set controls on audio signal generator as follows:

a. Tune "FREQUENCY" control for a reading of "100" on dial.

b. Set "RANGE" switch to "X10." The generator is now tuned to 1,000 cps.

c. Set attenuator controls for 60 db.

d. Adjust "AMPLITUDE" control for plus 15 dbm on meter. Output level is now 45 db below 1 mw.

e. Rotate "GAIN" control, on front panel of modulator-power supply, in a clockwise direction until Ballantine Vacuum Tube Voltmeter indicates 750 volts (times 10 multiplier permits 1,000-volt full scale reading).

f. Reset attenuator controls on audio signal generator to 40 db. Output level is now 25 db below 1 mw.

g. Rotate "LIMITER THRESHOLD" control, on front panel of modulator-power supply, in a clockwise direction until reading on Ballantine voltmeter drops to 590 volts.

h. Reset attenuator controls on audio signal generator to 60 db. Output level is now 45 db below 1 mw.

i. Record reading on Ballantine voltmeter in db of variation from 590 volts (let 590 volts equal reference level of 0 db). Maximum permissible variation is 4 db.

9-9. BROAD BAND AUDIO DISTORTION TEST. The over-all audio distortion should not exceed ten percent on any frequency between 200 cps and 20,000 cps at any input level between 45 db below 1 mw and 5 db above 1 mw, with the automatic modulation limiter circuit in operation (see paragraph 9-8). Proceed as follows to check for audio distortion. Do not touch any of the modulator-power supply front panel controls after completing the automatic modulation limiter test (see paragraph 9-8). Set controls on Hewlett-Packard Distortion Analyzer Model 330B (steps a through f):

a. Set "RMS-DB" switch to "100%" range.

b. Tune "FREQUENCY" control for a reading of "100" on dial. Upper control is for coarse tuning and lower control for fine tuning.

c. Set "RANGE" switch to "X10." The distortion analyzer is now tuned for operation at 1,000 cps.

d. Set "AF-RF" switch to "AF."

e. Set "NOISE-SET LEVEL-DISTORTION-METER" switch to the "SET LEVEL" position.

f. Set "INPUT" control at extreme counterclockwise ("MIN") position.

g. Slowly rotate the distortion analyzer "INPUT" control in a clockwise direction until the meter on the distortion analyzer reads full scale (1.0 volt on the 0-1.0 "R.M.S. VOLTS" scale).

h. Set distortion analyzer "NOISE-SET LEVEL-DISTORTION-METER" switch to the "DISTORTION" position.

i. Tune distortion analyzer "FREQUENCY" controls for minimum reading on distortion analyzer meter.

j. Set "RMS-DB" switch to "10%" range.

k. Carefully tune fine "FREQUENCY" and "BALANCE" controls for a minimum reading on the distortion analyzer meter.

l. Read the percentage distortion on the 0-1.0 "R.M.S. VOLTS" scale of the distortion analyzer. Full scale is ten percent.

9-10. POWER INPUT. (See figure 9-2.) The total input power required to operate the transmitter and modulator-power supply should not exceed 1,500 watts. The power factor should not be less than 85 percent. Proceed as follows to measure the power input.

a. Do not touch any of the transmitter or modulator-power supply controls after completing the broad band audio distortion test. (See paragraph 9-9.)

b. Adjust variac for a reading of exactly 115 volts on line voltmeter.

c. Read wattmeter for total power input.

d. Calculate power factor by using following formula:

$$PF = \frac{w}{va}$$

wherein PF = power factor
w = reading on wattmeter in watts
va = volt-amperes
= product of readings on line ammeter and line voltmeter

9-11. BROAD BAND AUDIO FREQUENCY RESPONSE. The modulator-power supply is provided with a "NARROW-BROAD" switch to change from narrow to broad band frequency response. The broad band frequency response should be flat within 4 db from

200 cps to 20,000 cps. Proceed as follows to check the audio frequency response at 200 cps and 20,000 cps. Complete the power input test. Adjust only controls as instructed. Set controls on audio signal generator as follows:

a. Tune "FREQUENCY" control for a reading of "200" on dial.

b. Set "RANGE" switch to "X1". The signal generator is now tuned to 200 cps.

c. Set attenuator controls for 60 db.

d. Adjust "AMPLITUDE" control for plus 15 dbm on meter. Output level is now 45 db below 1 mw.

e. Record reading on Ballantine voltmeter in db of variation from 590 volts (let 590 volts equal reference level of 0 db).

f. Tune audio signal generator "FREQUENCY" control for a reading of "200" on dial. Set "RANGE" switch to "X100". The signal generator is now tuned to 20,000 cps.

g. Readjust audio signal generator "AMPLITUDE" control for plus 15 dbm on meter.

h. Record reading on Ballantine voltmeter in db of variation from 590 volts.

9-12. NOISE TEST. The output noise level, with no audio frequency signal input, should be at least 40-db below 1,000 cps, 95 percent modulation level. Proceed as follows to check for noise.

a. Complete the broad band audio frequency test (see paragraph 9-11).

b. Set distortion analyzer "RMS-DB" switch to "O DB" range, "NOISE-SET LEVEL-DISTORTION-METER" switch to the "SET LEVEL" position and the "INPUT" control at extreme counter clockwise position.

c. Slowly rotate the distortion analyzer "INPUT" control in a clockwise direction until the meter on the distortion analyzer reads "O" on the decibels scale.

d. Connect jumper across audio signal generator "OUTPUT" terminals.

e. Set distortion analyzer function switch to the "NOISE" position. (This automatically adds 20 DB to the analyzer amplifier gain and the -20 DB must be added to the final noise figure.)

f. Decrease setting of "RMS-DB" switch (counter-clockwise) as far as necessary to obtain a large meter deflection.

g. Read noise level in minus db by taking difference between attenuator settings, steps a and f. (Each position on the "RMS-DB" switch is 10 db.) Add attenuation indicated on meter. Add the -20 db from step e above. For example, if the "RMS-DB" switch is turned one step counter-clockwise and the meter reads minus 11 db and step "e" adds minus 20 db, the noise level is minus 10, minus 11, and minus 20 which equals minus 41 db.

h. Remove jumper across audio signal generator "OUTPUT" terminals.

9-13. NARROW BAND AUDIO DISTORTION. The over-all audio distortion should not exceed ten percent when measured at 1,000 cps. Proceed as follows to check for audio distortion.

a. Turn the "BROAD-NARROW" switch, front of modulator-power supply, to "NARROW" position.

b. Turn the "LIMITER THRESHOLD" control, front of modulator-power supply, to extreme counterclockwise position. (Automatic modulation limiting not used during "NARROW" band checks.)

c. Set controls on audio signal generator same as in paragraph 9-8, steps a through d.

d. Rotate "GAIN" control, on front panel of modulator-power supply, from extreme counterclockwise position until Ballantine voltmeter indicates 590 volts.

e. Measure percentage distortion. Use procedure indicated in paragraph 9-9.

9-14. NARROW BAND NOISE TEST. The output noise level, with no audio frequency power input, should be at least 40 db below the 1,000 cps, 95-percent modulation level. Proceed as follows to check for noise.

a. Complete narrow band audio distortion test.

b. Measure noise. Use procedure indicated in paragraph 9-12, steps b through g.

9-15. NARROW BAND AUDIO FREQUENCY RESPONSE. The narrow band audio frequency response shall not vary more than 5 db between 400 and 3,000 cps; the response shall be attenuated at least 10 db at 200 cps and 5,000 cps. Proceed as follows to check the audio frequency response at 200, 400, 3,000 and 5,000 cps.

a. Complete narrow band noise test.

b. Reset controls on audio signal generator for 200 cps, output level of 45 db below 1 mw.

c. Record reading on Ballantine voltmeter in db of variation from 590 volts.

d. Repeat steps b and c at 400, 3,000, and 5,000 cps.

9-16. RESERVE AUDIO AMPLIFICATION. When the "GAIN" control, on front of modulator-power supply, is set in the extreme clockwise position, it shall provide at least 10 db of reserve audio amplification of any frequency between 200 and 20,000 cps in the broad frequency response condition and 400 and 3,000 cps in the narrow frequency response condition. Proceed as follows to check reserve audio amplification.

a. Turn the "BROAD-NARROW" switch, front of modulator-power supply, to "BROAD" position.

b. Reset controls on audio signal generator for 200 cps, output level of 45 db below 1 mw.

c. Rotate "GAIN" control, on front panel of modulator-power supply, to extreme clockwise position.

d. Adjust attenuators on audio signal generator for a reading of 590 volts on Ballantine voltmeter.

e. Subtract 60 db from output level of audio signal generator. Reserve audio amplification is equal to output level of audio signal generator minus 60 db. For example, if the attenuator controls and meter reading indicate an output level of 72 db, the reserve audio amplification is equal to 72 minus 60, equal 12 db.

f. Reset controls on audio signal generator for 20,000 cps.

g. Readjust attenuators on audio signal generator for a reading of 590 volts on Ballantine voltmeter.

h. Calculate reserve audio amplification (see step e).

i. Turn the "BROAD-NARROW" switch, front of modulator-power supply, to "NARROW" position.

j. Reset controls on audio signal generator for 400 cps.

k. Repeat steps d and e.

l. Reset controls on audio signal generator for 3,000 cps.

m. Repeat steps d and e.

9-17. MICROPHONE CIRCUIT TEST. Proceed as follows to check the microphone input circuit.

a. Insert the plug of a T-17 microphone into the "MIKE" jack on the front of the modulator-power supply.

b. Turn "PUSH TO TALK-CARRIER ON" switch to "PUSH TO TALK" position.

c. Adjust "AMPLITUDE" control on audio signal generator to extreme counterclockwise position.

d. Depress microphone button; Whistle softly into mouthpiece. Normal indication on oscilloscope is a wave approaching sinusoidal pattern.

e. Release microphone button.

9-18. "EMER-NORMAL" TEST. Proceed as follows to check for proper operation when the "EMER-NORMAL" switch is in the "EMER" position.

a. Adjust audio signal generator "AMPLITUDE" control for plus 15 dbm on meter.

b. Turn "EMER-NORMAL" switch to "EMER" position. Should get sine wave on oscilloscope when switch is thrown.

c. Reset "EMER-NORMAL" switch to "NORMAL" position.

9-19. "BUCK-BOOST" TEST. If the supply line voltage is high (above the nominal value of 115 or 230-volts ac), the voltage to the power transformers should be reduced by five volts when the "BUCK-BOOST" switch is turned to the "BUCK" position. Likewise, if the supply line voltage is low, the voltage to the power transformers should be increased by five volts when the "BUCK-BOOST" switch is turned to the "BOOST" position. Proceed as follows to check the "BUCK-BOOST" circuit.

a. Turn "BUCK-BOOST" switch to "BUCK" position.

b. Depress button on T-17 microphone. The reading on the "115 VOLT AC SUPPLY" voltmeter on the test unit should be 110 plus or minus 2 volts.

c. Reset "BUCK-BOOST" switch to "BOOST" position.

9-20. 230-VOLT INPUT TEST. Proceed as follows to check the power input circuit for operation from a supply line of 230-volts ac.

a. Turn the "POWER" switch, on front panel of modulator-power supply, to the "OFF" position.

b. Remove power cable assembly connector from "AC POWER INPUT" jack at rear of modulator-power supply.

c. Set link O-202 to 230-volt position. (See figure 9-3.)

d. Reconnect power cable assembly to "AC POWER INPUT" jack at rear of modulator-power supply.

e. Turn the "POWER" switch, on front panel of modulator-power supply, to the "ON" position.

f. Wait approximately 60 seconds (for time delay circuit to function) and then depress button on T-17 microphone. Meter readings on test unit should be same as noted in paragraph 9-7, step g.

g. Release button on microphone.

h. Repeat steps a and b.

i. Reset link O-202 to 115-volt position (See figure 9-3.) This concludes testing of the modulator-power supply.

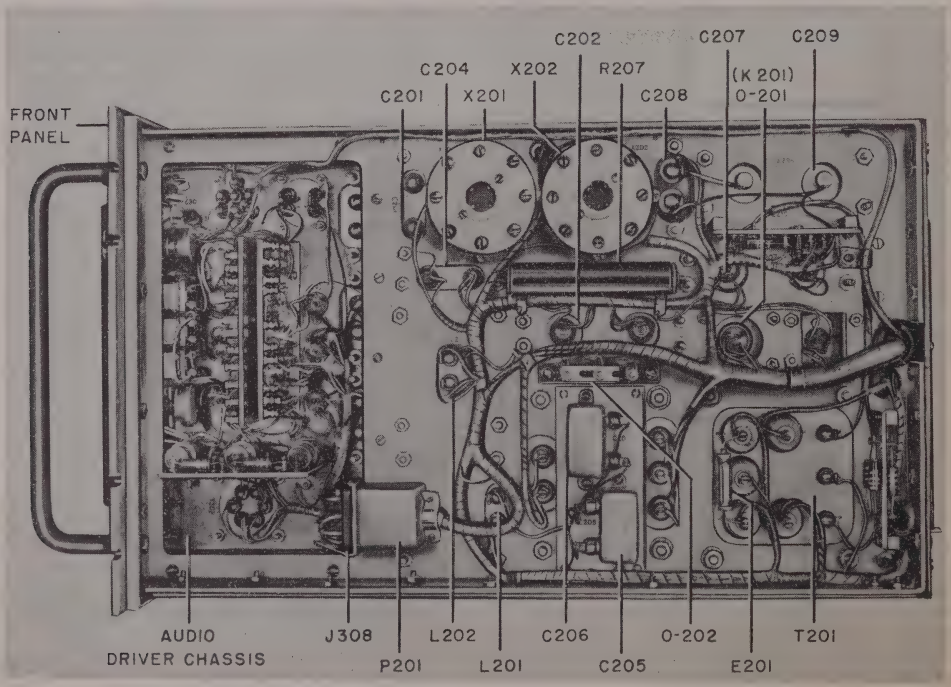


Figure 9-3. Modulator-Power Supply, Right Side, Dust Cover Removed

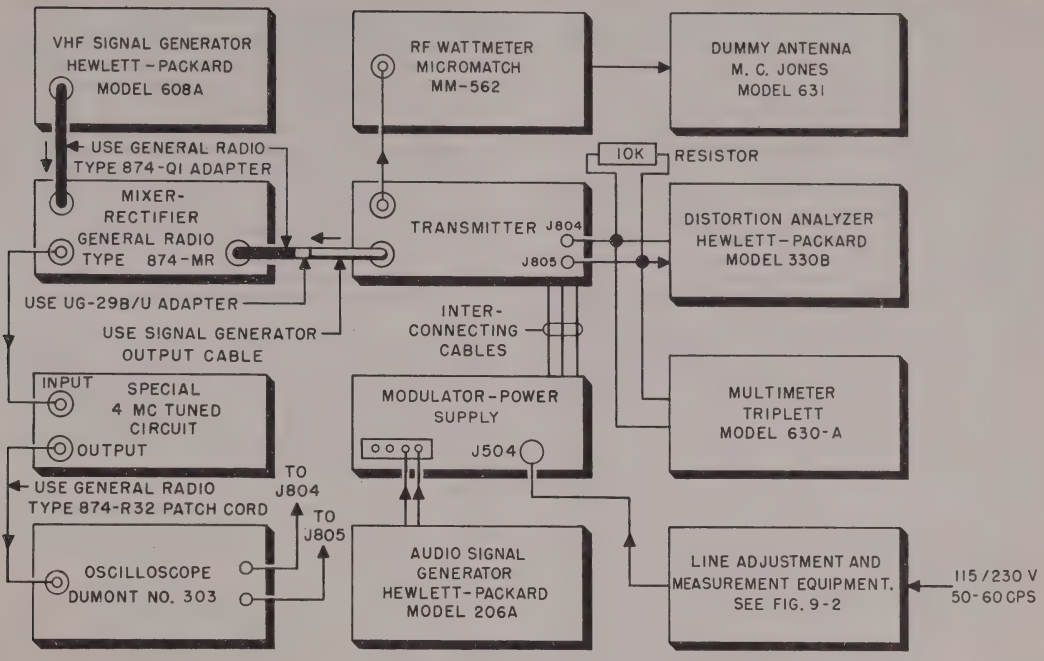


Figure 9-4. Transmitter, Set-Up for Final Electrical Test

9-21. FINAL ELECTRICAL TEST FOR TRANSMITTER.

9-22. Before the transmitter can be given a final electrical test, check to see that the following conditions have been fulfilled:

a. All tests described in paragraphs 8-5 through 8-12 have been performed.

b. The unit is completely assembled; the monitor-screen modulator assembly and exciter subassembly are in place and connected to the transmitter, by reversing the steps for removal of the monitor-screen modulator assembly and exciter subassembly; see Section V of the applicable Handbook of Service Instructions.

9-23. EQUIPMENT RECOMMENDED. The following test equipment is recommended to perform the final electrical tests for the transmitter (see figure 9-4):

a. Hewlett-Packard Model 330B Distortion Analyzer.
b. Hewlett-Packard Model 206A Audio Signal Generator.
c. Dumont No. 303 Cathode Ray Oscillograph.
d. Superior Electric Powerstat Type 1226.
e. General Electric No. AP-9 A-C Voltmeter.
f. General Electric No. AP-9 A-C Ammeter.
g. General Electric No. AP-9 Wattmeter.
h. Triplett Model 630-A multimeter.
i. M.C. Jones Model 631 dummy antenna.
j. M.C. Jones Model MM 562 r-f wattmeter.
k. Hewlett-Packard Model 608A VHF Signal Generator.
l. General Radio Type 874-MR Mixer-Rectifier.
m. General Radio Type 841-Q1 adaptor (two required).
n. JAN type UG-29B/U adaptor.
o. General Radio Type 874-R32 Patch Cord.
p. Special 4-mc transformer assembly. (See paragraph 2-11.)

9-24. MODULATOR-POWER SUPPLY CONTROL SETTINGS. Set the following controls on the modulator-power supply as indicated below.

a. Turn "POWER" switch S403 to "OFF."
b. Turn "PLATE" switch S401 to "OFF."
c. Turn "PUSH TO TALK-CARRIER ON" switch S302 to "CARRIER ON" position.
d. Turn "EMER-NORMAL" switch S301 to "NORMAL" position.
e. Turn "NARROW-BROAD" switch S303 to "BROAD" position.
f. Turn "GAIN" control R306 to extreme counterclockwise position.
g. Turn "LIMITER THRESHOLD" control R335 to extreme counterclockwise position.
h. Set jumper O-202 (line voltage adjustment) to "115 VOLT" position.
i. Turn "BUCK-BOOST" switch S502 (rear panel) to "BOOST" position.
j. Rotate all pilot light dimmers to extreme counterclockwise (open) position.

9-25. TRANSMITTER CONTROL SETTINGS. Set the following controls on the transmitter as indicated below:

a. Turn "OUTPUT COUPLING" control to extreme clockwise position.
b. Turn "TUNE-OPERATE" switch S801 to "TUNE" position.
c. Loosen all dial locks.
d. Remove cover over crystal oven.
e. Set "METER 1 SELECTOR SWITCH" to "1."
f. Set "METER 2 SELECTOR SWITCH" to "CARRIER WATTS" position.
g. Take off "REMOVE TO EXPOSE TEST POINTS" cover plate to expose transmitter test jacks.

9-26. TEST SET-UP. Connect test equipment to the transmitter in the following manner:
a. Connect a power line to the "AC POWER INPUT" connector J504, located on the rear panel of the modulator-power supply. This power line should be provided with a variac and meters to permit adjustments of the power line voltage. See figure 9-2 for the recommended set-up for line adjustment and power input measurement.
b. If the transmitter under test is mounted in the same rack as the modulator-power supply, interconnect the two units with the three interconnecting cables that are part of Radio Transmitting Set AN/GRT-3. If the units are on a workbench, interconnection must be made with the three specially fabricated cables described in paragraphs 2-6 through 2-9. Alternately, the transmitter can be connected to the special test unit described in paragraph 2-5.
c. Connect the following test equipment between test jacks J804 and J805 on front of transmitter: 10,000-ohm resistor, "METER" terminals of distortion analyzer, "HOR" terminals of Dumont Oscilloscope No. 303, and Triplett Model 630-A multimeter (on 12 V DC range).
d. Set "IMPEDANCE" control, of Hewlett-Packard Audio Signal Generator Model 206A, to "600;" connect jumper between "CT" and "G" of "OUTPUT" terminals; connect "OUTPUT" to "LINE" terminals on rear of modulator-power supply.
e. Connect a General Radio Type 874-MR Mixer Rectifier at the "TO ANTENNA INPUT" connector at the rear of the transmitter. A sample of the transmitted power will be obtained as a result of leakage between contacts of the transmitter antenna send-receive relay.
f. Connect a Hewlett-Packard VHF Signal Generator Model 608A to other input connector of mixer rectifier.
g. Connect output of mixer rectifier to input of special 4-mc tuned circuit described in paragraph 2-10.
h. Connect "VERT" terminals of oscilloscope to output of special 4-mc tuned circuit.
i. Connect calibrated r-f wattmeter, eg, M.C. Jones Model MM 562, at "TO ANTENNA" connector, rear of transmitter; the wattmeter consists of a directional coupler and an indicating device. Connecting r-f cable must have maximum length of eight inches.
j. Connect M.C. Jones Model 631 coaxial resistor (dummy antenna) to output side of r-f wattmeter.

9-27. TUNING PROCEDURE (400 MC). The following steps indicate the procedure required to tune the transmitter:
a. Insert special 11.11-mc crystal into crystal oven and plug oven into socket provided on front panel of transmitter.
b. Turn "POWER" switch to the "ON" position. The green indicator above the switch will light.
c. Adjust variac and maintain line voltage at 115 volts throughout the tests that follow.
d. Allow at least five minutes warm-up before proceeding with the tuning operations.
e. Tune the "MAIN TUNING" dial to 400 mc and make the dial lock finger tight.

NOTE

Do not manipulate "MAIN TUNING" dial unless all dial locks are open.

f. Turn "PLATE" switch to the "ON" position. The red indicator, above the switch, will light. In normal operation, it will take a time delay of approximately one minute after the "POWER" has been turned on, until the "PLATE" will operate.
g. A reading of approximately 0.05 milliamperes should be observed on "METER 1."
h. Set "METER 1 SELECTOR SWITCH" to position "2" and tune "OSC & 1ST DOUBLER PLATES" control until "METER 1" reads maximum. A reading of approximately 0.42 milliamperes should be observed on "METER 1."
i. Set "METER 1 SELECTOR SWITCH" to position "3" and tune the "2ND DOUBLER PLATE" control until "METER 1" reads maximum. A reading of approximately 0.39 milliamperes should be observed on "METER 1."
j. Set "METER 1 SELECTOR SWITCH" to position "4" and tune the "BUFFER AMPLR PLATE" control until "METER 1" reads minimum.
k. Set "METER 1 SELECTOR SWITCH" to position "5" and tune the "DRIVER GRID" control until "METER 1" reads maximum.
l. Readjust the "BUFFER AMPLR PLATE" and "DRIVER GRID" controls to obtain a maximum reading on "METER 1." Several successive adjustments of these two controls will be necessary before a true maximum reading can be obtained. A reading of approximately 0.68 milliamperes should be observed on "METER 1."
m. Set "METER 1 SELECTOR SWITCH" to position "7" and tune the "DRIVER PLATE" control until "METER 1" reads minimum. Normal indication on "METER 1" is approximately 0.79 milliamperes.
n. Set "METER 1 SELECTOR SWITCH" to position "6" and tune the "PA GRID" control to obtain a maximum reading on "METER 1."
o. With "METER 1 SELECTOR SWITCH" still on position "6," manipulate the "PA GRID" and "DRIVER PLATE" controls until "METER 1" reads maximum. If resultant reading on meter is greater than 0.4 milliamperes, detune "PA GRID" control until meter reads 0.4 milliamperes.
p. Tune the "PA PLATE" control until "METER 2" reads maximum.
q. Set "METER 1 SELECTOR SWITCH" to position "8," throw the "TUNE-OPERATE" switch to the "OPERATE" position and tune the "PA PLATE" control until "METER 2" reads maximum.
r. Manipulate the "PA PLATE" and "OUTPUT COUPLING" controls for maximum power output.

s. Adjust "PA CUR" control R719, right side of monitor-screen modulator assembly, for reading of 0.5 milliamperes on "METER 1." Lock control.
t. Power output indication on calibrated r-f wattmeter must be greater than 100 watts.

9-28. MONITOR-SCREEN MODULATOR ADJUSTMENTS. Paragraphs 9-29 through 9-32 give the step by step procedure required to set four of the five screw driver adjusted controls (potentiometers), that are located on the right side of the monitor-screen modulator assembly. They are accessible when the transmitter dust cover is removed. (See figure 9-5.) The adjustment of the fifth control was given in paragraph 9-27, step s.

9-29. R-F POWER OUTPUT INDICATOR ADJUSTMENT. The following steps indicate the procedure required to calibrate "METER 2" for r-f power output measurement.
a. Adjust the "OUTPUT COUPLING" control until the calibrated r-f wattmeter indicates exactly 100 watts.
b. Adjust "PWR CAL" control R701, right side of monitor-screen modulator assembly, until "METER 2" indicates exactly 100 watts. Lock "PWR CAL" control.

9-30. MODULATION LINEARITY ADJUSTMENT. The following steps indicate the procedure required to adjust the screen modulator in order to secure linear modulation:
a. Remove the 11.11-mc crystal from the crystal oven and replace with special 6.25-mc crystal.
b. Return the transmitter for 225-mc output. Refer to paragraph 9-27 for tuning procedure. (Omit steps.)
c. Refer to Table 9-1 for typical transmitter meter readings at 225, 300, and 400 mc.
d. Set controls on audio signal generator so that "FREQUENCY" control reads "100" on dial, "RANGE" switch is set to "X10" (the generator is now tuned to 1,000 cps), attenuator controls set for 60 db, and the "AMPLITUDE" control adjusted for plus 15 dbm on meter. (Output level is now 45 db below 1 mw.)
e. Set controls on distortion analyzer so that "RMS VOLTS-DB" is set to "10 RMS VOLTS" position, and the "METER-DISTORTION-SET LEVEL-NOISE" switch is set to "METER" position.
f. Adjust vhf signal generator for maximum output at a frequency approximately 4-mc above or below transmitter output frequency.
g. Adjust oscilloscope vertical amplifier gain control for maximum gain.
h. Slowly readjust frequency control of vhf signal generator for maximum vertical deflection on oscilloscope.
i. If vertical deflection on oscilloscope is too great (more than half the screen diameter), reduce the gain of the oscilloscope vertical amplifier.
j. Adjust "GAIN" control, front of modulator-power supply, for approximately 90 percent modulation (reading of approximately 5.4-volts R.M.S. on distortion analyzer meter).
k. Set oscilloscope to external sweep and adjust

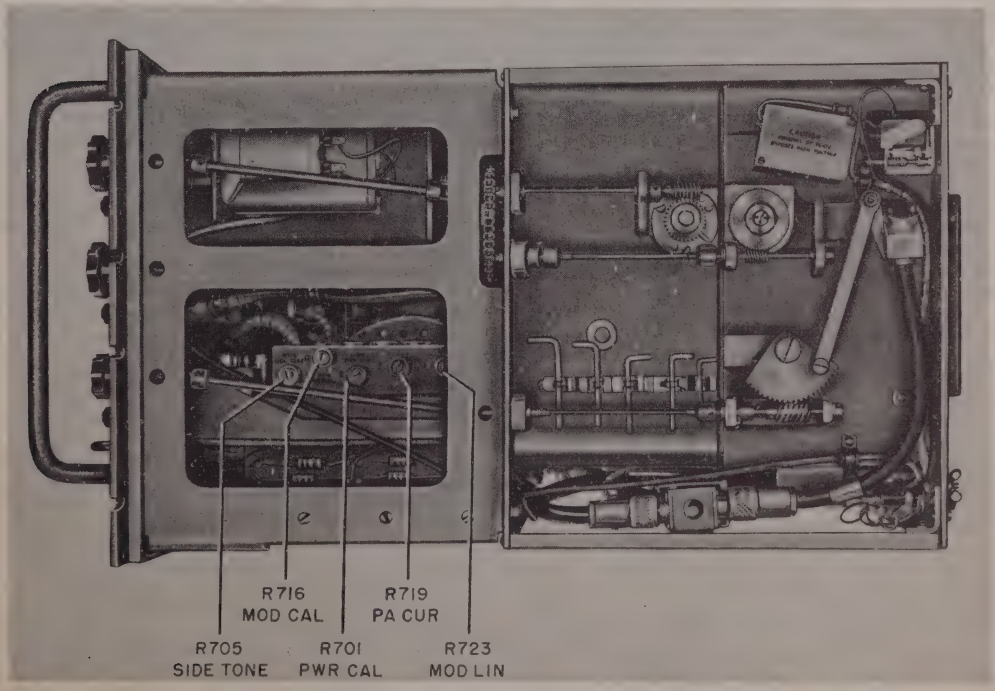


Figure 9-5. Transmitter, Right Side, Dust Cover Removed

horizontal amplifier gain control for horizontal deflection of approximately half the screen diameter.
l. Repeat step h.
m. Adjust "MOD LIN" control R723, right side of monitor-screen modulator assembly for linear modulation, i.e., straight sided trapezoidal pattern on the oscilloscope. Lock "MOD LIN" control.

9-31. PERCENT MODULATION INDICATOR ADJUSTMENT. The following steps indicate the procedure required to calibrate "METER 2" for percent modulation measurement:
a. Record meter reading on distortion analyzer (a-c volts) and multimeter (d-c volts); calculate percent modulation from formula:

$$\text{Percent modulation} = 1.41\frac{\text{a-c volts}}{\text{d-c volts}}$$

b. Set "METER 2 SELECTOR SWITCH" to "SET CAL" position.
c. Adjust transmitter "CALIBRATE" control for "CAL" on "METER 2."
d. Set "METER 2 SELECTOR SWITCH" to "% MOD" position.
e. Adjust "MOD CAL" control R716, right side of monitor-screen modulator assembly, until "METER 2" indicates calculated value of percent modulation. Lock "MOD CAL" control.

9-32. SIDE TONE OUTPUT ADJUSTMENT. The following steps indicate the procedure required to secure 1 mw output at the transmitter "SIDE TONE OUTPUT" jack, with an input level of 45 db below 1 mw, at the "LINE" terminals of the modulator-power supply.
a. Connect a 600-ohm resistor (or 600-ohm headset) and the distortion analyzer "METER" terminals (after disconnecting from J804 and J805 on front of transmitter) to "SIDE TONE OUTPUT" jack on front of transmitter.
b. Set distortion analyzer "RMS VOLTS-DB" switch to "O DB" position.
c. Adjust "SIDE TONE" control R705, right side of monitor-screen modulator, for 0 db (1 mw) reading on distortion analyzer meter. Lock "SIDE TONE" control.

9-33. BROAD BAND AUDIO DISTORTION TEST. The over-all systems audio distortion ("LINE" terminals to "SIDE TONE OUTPUT" jack) should not exceed twelve percent on any frequency between 200 cps and 20,000 cps at any input level between 45 db below 1 mw and 5 db above 1 mw, with the automatic modulation limiter circuit in operation. Proceed as follows to check for audio distortion:
a. Check controls on audio signal generator to see that they are set for 1,000 cps and an output level of 45 db below 1 mw.
b. Disconnect distortion analyzer "METER" terminals from "SIDE TONE OUTPUT" jack and reconnect between J804 and J805 on front of transmitter. Reset "RMS-DB" switch to "10 RMS VOLTS" position.
c. Adjust "GAIN" control, front of modulator-power supply, for distortion analyzer "METER" reading of 7.5 volts (equivalent to modulation level 1 db above 95 percent).
d. Reset attenuator controls on audio signal generator to 40 db. Output level is now 25 db below 1 mw.
e. Rotate "LIMITER THRESHOLD" control, on front panel of modulator-power supply, in a clockwise direction until "METER" reading drops to 5.9 volts.
f. Reset attenuator controls on audio signal generator to 60 db. Output level is now 45 db below 1 mw.
g. Connect "AF INPUT" terminals of distortion analyzer to "SIDE TONE OUTPUT" jack.
h. Set controls on distortion analyzer as follows:
i. Set "RMS-DB" switch to "100%" range.
j. Tune "FREQUENCY" control for a reading of "100" on dial. Upper control is for coarse and lower control is for fine tuning.
k. Set "RANGE" switch to "X10." The distortion analyzer is now tuned for operation at 1,000 cps.
l. Set "AF-RF" switch to "AF."
m. Set "NOISE-SET LEVEL-DISTORTION-METER" switch to the "SET LEVEL" position.
n. Set "INPUT" control at extreme counterclockwise ("MIN") position.
o. Slowly rotate the distortion analyzer "INPUT" control in a clockwise direction until the meter on the distortion analyzer reads full scale (1.0 volt on the 0-1.0 "R.M.S. VOLTS" scale).
p. Set distortion analyzer "NOISE-SET LEVEL-DISTORTION-METER" switch to the "DISTORTION" position.
q. Tune distortion analyzer "FREQUENCY" controls for minimum reading on distortion analyzer meter.
r. Set "RMS-DB" switch to "10%" range.
s. Carefully tune fine "FREQUENCY" and "BALANCE" controls for a minimum reading on the distortion analyzer meter.
t. Read the percentage distortion on the 0-1.0 "R.M.S. VOLTS" scale of the distortion analyzer. Full scale is 10 percent.
u. Reset controls on audio signal generator for 200 cps and an output level of 45 db below 1 mw.
v. Reset "FREQUENCY" control and "RANGE" switch of distortion analyzer so as to tune for operation on 200 cps.
w. Repeat steps h through n (except as altered by step p). This checks the over-all distortion at 200 cps.
x. Reset controls on audio signal generator for 20,000 cps and an output level of 45 db below 1 mw.
y. Reset "FREQUENCY" control and "RANGE" switch of distortion analyzer so as to tune for operation on 20,000 cps.
z. Repeat steps h through n (except as altered by step t).
This checks the over-all distortion at 20,000 cps.

9-34. BROAD BAND AUDIO FREQUENCY RESPONSE. The over-all broad band frequency response ("LINE" terminals to "SIDE TONE OUTPUT" jack) should be flat within 6 db, from 200 cps to 20,000 cps. Proceed as follows to check the audio frequency response at 200 cps and 20,000 cps.
a. Complete the broad band audio distortion test. Do not adjust any controls except as instructed in the steps that follow.
b. Set controls on distortion analyzer so that the "RMS-DB" switch is on the "10 RMS VOLTS" position and the "NOISE-SET LEVEL-DISTORTION-METER" switch is on the "METER" position.

c. Record reading on distortion analyzer meter in db variation from 5.9 volts (let 5.9 volts equal reference level of zero db).
d. Set audio signal generator "RANGE" switch to "X1." The generator is now tuned to 200 cps.
e. Readjust audio signal generator "AMPLITUDE" control for plus 15 dbm on meter.
f. Record reading on distortion analyzer meter in db of variation from 5.9 volts.

9-35. NOISE TEST. The output noise level, with no audio frequency signal input, should be at least 40-db below 1,000 cps, 95 percent modulation level. Proceed as follows to check for noise.
a. Complete the broad band audio frequency response test. Do not adjust any controls except as instructed in the steps that follow.
b. Set distortion analyzer "RMS-DB" switch to "O DB" range, "NOISE-SET LEVEL-DISTORTION-METER" switch to the "SET LEVEL" position and the "INPUT" control at extreme counter clockwise position.
c. Slowly rotate the distortion analyzer "INPUT" control in a clockwise direction until the meter on the distortion analyzer reads "O" on the decibels scale.
d. Connect jumper across audio signal generator "OUTPUT" terminals.
e. Set distortion analyzer function switch to the "NOISE" position. (This automatically adds 20 DB to the analyzer amplifier gain and the -20 DB must be added to the final noise figure.)
f. Decrease setting of "RMS-DB" switch (counterclockwise) as far as necessary to obtain a large meter deflection.
g. Read noise level in minus db by taking difference between attenuator settings, steps a and f. (Each position on the "RMS-DB" switch is 10 db.) Add attenuation indicated on meter. Add the -20 db from step e above. For example, if the "RMS-DB" switch is turned one step counter-clockwise and the meter reads minus 11 db and step "e" adds minus 20 db, the noise level is minus 10, minus 11, and minus 20 which equals minus 41 db.
h. Remove jumper across audio signal generator "OUTPUT" terminals.

9-36. 300-MC OPERATION. The following steps indicate the procedure required to check the transmitter at 300 mc.
a. Set "GAIN" control, front of modulator-power supply, to extreme counterclockwise position.
b. Replace crystal within crystal oven with one required for operating frequency of approximately 300 mc.
c. Set "TUNE-OPERATE" switch to "TUNE" position.
d. Retune transmitter. Refer to paragraph 9-27 for tuning procedure. (Omit step s).
e. Refer to Table 9-1 for typical transmitter meter readings.

9-37. RESETTABILITY. When retuned to 225 mc, and 400 mc, the transmitter power output must not change more than ten percent from the previously recorded values; in addition, the power output must not fall below 100 watts. Proceed as follows to check resettability.
a. Replace crystal within crystal oven with one required for operating frequency of 225 mc and retune transmitter for 225-mc operation. Note power output on "METER 2."
b. Repeat step a for 300 mc.
c. Repeat step a for 400 mc. This concludes testing of the transmitter.

9-38. TYPICAL METER READINGS.

9-39. The following table represents a list of typical meter readings obtained for transmitter frequencies of 225 mc, 300 mc, and 400 mc, and may be used as a guide for the whole tuning range of the transmitter.

TABLE 9-1. TYPICAL TRANSMITTER READINGS

Selector Switch	Switch Position	Current Measured	Meter Readings ***			Actual Current		
			225 mc	300 mc	400 mc	225 mc	300 mc	400 mc
1	1	Crystal	0.05	0.04	0.03	0.10	0.08	0.06
1	2	V603 grid	0.35	0.36	0.23	0.70	0.72	0.46
1	3	V604 grid	0.28	0.26	0.064	1.40	1.30	0.32
1	4	V604 plate	0.63	0.56	0.69	63	56	69
1	5	V901 grid	0.81	0.71	0.66	16.2	14.2	13.2
1	6	PA grid	0.40	0.40	0.32	20	20	16
1	7	V901 plate	0.40	0.60	0.83	80	120	166
1	* 8	PA plate	0.38	0.39	0.32	190	195	160
1	** 8	PA plate	0.57	0.58	0.51	285	290	255
2	* "CARRIER WATTS"		75 w	50 w	55 w			
2	** "CARRIER WATTS"		150 w	130 w	125 w			

* "TUNE-OPERATE" switch in "TUNE" position.

** "TUNE-OPERATE" switch in "OPERATE" position.

*** All meter readings in milliamperes unless otherwise indicated.

SECTION X

FINAL REASSEMBLY

10-1. No instructions, other than those given in Sections VIII or IX are required for final reassembly of this equipment.

SECTION XI

INSPECTION AND TESTING

11-1. GENERAL.

11-2. For test and alignment procedures, see Section VI of the applicable Handbook of Service Instructions.

11-3. MINIMUM PERFORMANCE AND TEST VALUES. Minimum performance and test values have been included in Sections VIII and IX, for each test performed.

11-4. Marking of equipments required by Government T.O.'s or other instructions, to indicate overhaul or the incorporation of changes, shall be applied during inspection and test (if not previously applied to subassemblies, assemblies, or components during overhaul and assembly).

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